

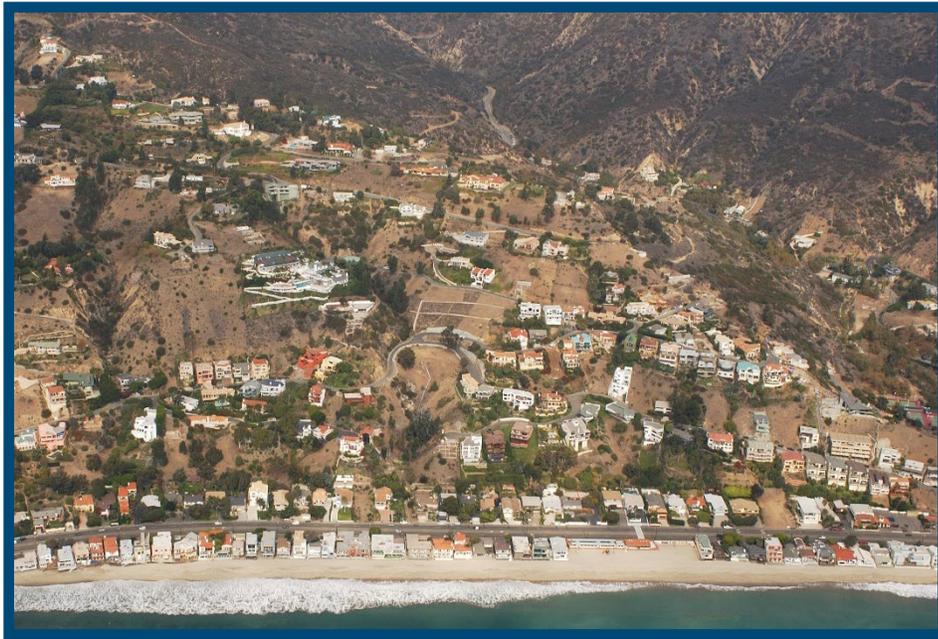
FY23/24 Maintenance and Monitoring

AD98-2, Calle del Barco

City of Malibu, California

Yeh Project No.: 220-277

March 15, 2025



Prepared for:

City of Malibu

23825 Stuart Ranch Rd.

Malibu, California 90265

Attn: Mr. Arthur Aladjajian

Prepared by:

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March 15, 2025

Project No. 220-277

City of Malibu
23825 Stuart Ranch Rd.
Malibu, California 90265

Attn: Mr. Arthur Aladjajian, Public Works Superintendent

Subject: Annual Monitoring and Maintenance Report FY23/24, City of Malibu Assessment District 98-2, Calle del Barco, Malibu, CA

Dear Mr. Aladjajian:

Yeh and Associates, Inc. is pleased to submit this monitoring and maintenance report for FY23/24 City of Malibu Assessment District AD-2, Calle del Barco in Malibu, California. This report was prepared in accordance with our Agreement for Professional Services, dated June 22, 2020 between the City of Malibu and Yeh and Associates, Inc. and Amendment 1, dated June 25, 2024. This report provides a geotechnical and annual summary of monitoring and maintenance for the project over fiscal year July 1, 2023, to June 30, 2024.

The geotechnical services consisted of monitoring and maintenance, data management, public outreach, reporting, and capital improvements. A map showing the location of the maintenance and monitoring facilities is provided on Plate 1. Plate 2 provides a summary of maintenance activities performed during the monitoring year.

We appreciate the opportunity to be of service. Please contact Nick Simon at 805-414-0991 or nsimon@yeh-eng.com if you have questions or require additional information.

Sincerely,
YEH AND ASSOCIATES, INC.


Nick Simon, GIT
Senior Project Geologist


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1. PURPOSE AND SCOPE OF STUDY

Yeh and Associates (Yeh) was retained by the City of Malibu (City) to perform maintenance and monitoring of the existing geotechnical instrumentation and dewatering facilities within the City of Malibu's Calle del Barco Landslide Assessment District, 98-2. The project location is shown by the polygon in Figure 1. This report presents monitoring results, a maintenance summary, and facilities status for July 2023 through July 2024 (monitoring year). Yeh monitors groundwater levels, surveys slope inclinometers, and measures the dewatering flow from dewatering wells and horizontal drains. Yeh also oversees and maintains function of the monitoring and dewatering facilities. Plate 1 shows the approximate locations of the assessment district facilities. Table 1 summarizes the equipment inventory and the approximate frequency of monitoring and maintenance over the monitoring year. Plate 2 and Section 4.0 of this report provides detailed summary of the maintenance activities performed during this monitoring period.

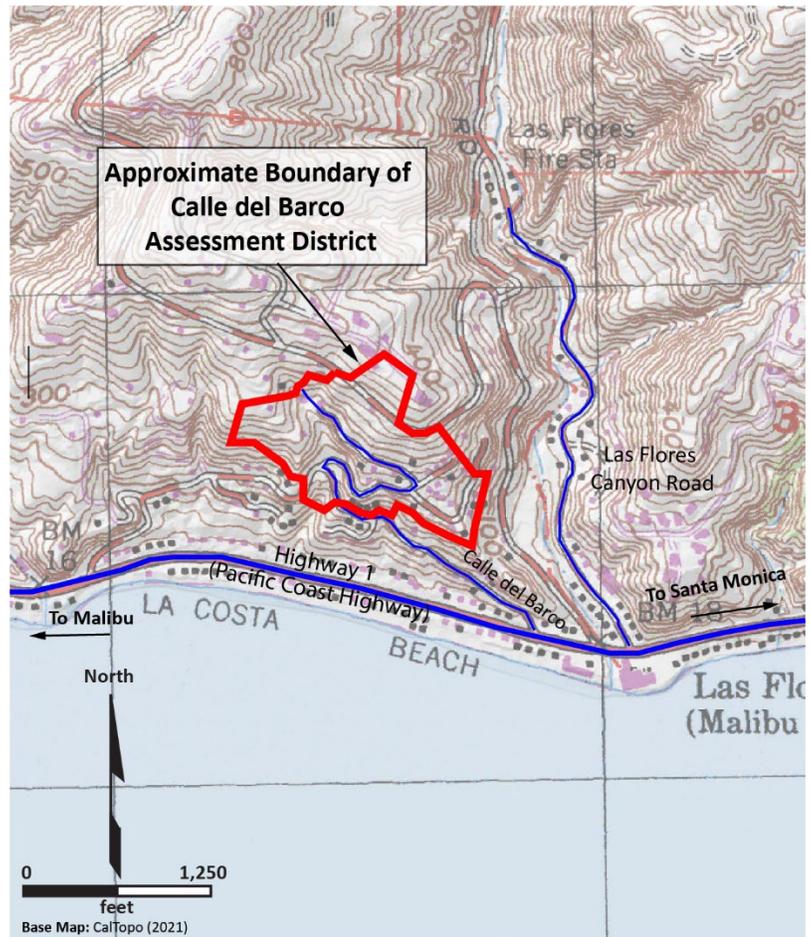


Figure 1: Project Location Map

Table 1. Summary of Annual Monitoring and Maintenance

Type of Monitoring Instrument or Dewatering Device	Number of Locations	Brief Description	Monitoring Frequency	Maintenance Effort ¹
Standpipe piezometer	8	2.75-inch perforated PVC casing used to measure depth to groundwater using electric sounder or by a transducer/datalogger	monthly; hourly data from pressure transducer	low
Inclinometer survey casings	12	1.5-inch and 2.75-inch diameter grooved casings made of PVC, used to survey for shear displacement by an inclinometer probe	quarterly	low
Dewatering wells	11	6-inch or 12-inch diameter steel or PVC casings equipped with 0.5 to 1.5HP submersible pump and connected to electrical controls, pumped water flows through meter and into conveyance piping to discharge	monthly	high
Horizontal Drains (hydraugers)	11	1-inch to 1.5-inch perforated PVC casings drilled slightly higher than horizontal into slope through the soldier pile wall along Rambla Orienta and at the toe of the landslide below Rambla Vista. Installed hundreds to thousands of feet into the slope and used to drain groundwater that intercepts the casing. Flow can be measured from the hydraugers before it flows to discharge	monthly	medium
Big Rock Mesa Rain Gauge #1239	1	Documented Rainfall, Data obtained from Los Angeles County Public Works	monthly	N/A
Notes: ¹ - maintenance effort (generalized): “high” – services monthly, “medium” – services quarterly, “low” – services annually				

2. MONITORING

The following provides the result of monitoring the water level in standpipe piezometers and the results of inclinometer surveys performed. For the purposes of discussion and context throughout the report, the monitoring results are discussed with respect to three areas within the landslide boundaries: Rambla Vista, Calle Del Barco and Rambla Pacifico:

- **Rambla Vista** is located in the southern portion of the 1978 landslide boundary, near the mapped toe of the landslide.
- **Calle del Barco** encompasses the middle portion of the 1978 Landslide. District facilities are located along Calle Del Barco and on the slope south of Calle del Barco. This area includes the headscarp area of the repaired 1998 shallow failure.
- **Rambla Pacifico** is the northern most geographic region and includes the headscarp portion of the 1978 landslide.



2.1 GROUNDWATER LEVELS

Groundwater levels were measured approximately monthly in 8 standpipe piezometers located on Plate 1. Water levels are acquired by lowering an electric probe into the standpipe to contact the groundwater surface and manually recording the depth to water. Appendix A presents groundwater hydrographs that extend through the end of the current monitoring year for individual standpipes.

Pneumatic piezometers were installed with some of the inclinometers up until 1998. Most of the existing pneumatic piezometers no longer function and the reliability of some of the remaining locations is not certain. Pneumatic piezometers were not measured during the monitoring year. Appendix A includes historic pneumatic piezometer results.

Table 2 summarizes the average groundwater levels over the monitoring year for each of the three areas, their change from the prior monitoring years area averages, and change from the historical area averages. Average annual groundwater elevations for the three areas remained relatively consistent over the first half of the monitoring year but increased in response to the heavy rainfall in January to April. In general water levels in individual standpipes increased following the rainfall events between December through May. Additional discussion by area is provided in the following sections:

Table 2: Summary of Area Average¹ Groundwater Elevations

Area Averaged	Total No. of Standpipes Monitored	2023-2024 Area Average Groundwater Elevation (ft)	Change in Area Averaged Groundwater Elevation from Prior Monitoring Year (ft)	2023-2024 Area Average Groundwater Elevation from Historical Area Average Groundwater Elevation (ft)
Rambla Vista	2	167.3	+5.5	+0.5
Calle Del Barco	4	248.2	+4.6	-10.6
Rambla Pacifico	2	354.2	+3.7	+3.9

Notes:
¹ Comparison between the current and prior monitoring periods for the eight standpipe piezometers measured during the current monitoring year: SI-4, SI-5, SI-7, SI-9, SI-13, SI-14, SI-15, SI-16

2.1.1 RAMBLA VISTA

Two standpipes are used for groundwater level monitoring in the Rambla Vista Area: SI-4 and SI-7. Table 3 summarizes the recorded measurements over the monitoring year and changes from historic water level averages for each standpipe. It is not atypical for water levels in SI-4 to vary seasonally on the order of 10 to 15 feet. During the monitoring year, water levels in SI-7 and SI-4 rose in response to rainfall. The groundwater level in SI-7 peaked in March of 2024



and has since declined to within about a foot of previous levels. Water levels in SI-4 began to decline in May 2024 but remain elevated above pre-season levels.

Table 3: Rambla Vista Area Water Level Monitoring

Standpipe ID	Change in Groundwater Elevation between last and first measurements of monitoring year (ft)	2023-2024 Average Groundwater Elevation (ft)	Change in Average Groundwater Elevation from Prior Monitoring Year (ft)	1991-2024 Historical Mean Groundwater Elevation (ft)	2023-2024 Average Groundwater Elevation from Historical Mean Groundwater Elevation (ft)
SI-4	+8.8	182.8	+10.5	179.8	+3.0
SI-7	+0.7	151.7	+0.5	157.0	-5.3

2.1.2 CALLE DEL BARCO

Five standpipes are used for groundwater level monitoring in the Calle Del Barco Area: SI-5, SI-8, SI-9, SI-15 and SI-16. Table 4 summarizes the recorded measurements over the monitoring year and changes from historic water level averages for each standpipe. SI-8 was not able to be measured due to limited access to the private property it is within. Standpipes SI-9, -15 and -16 all recorded water level increases of 4 feet or less after January 2024 and each have since begun to decline or have already dissipated to within a few feet of r pre-wet season measured levels. Water levels in SI-15 have remained elevated since the rainfall during the winter of 2022-2023. Water levels in standpipe SI-5 have been increasing since September 2022 and are known to be influenced by pumping rates in well W-M. Water levels in SI-5 remain elevated despite continued above average production from W-M. Yeh will continue to investigate the reason why water levels remain elevated.

Table 4: Calle del Barco Area Water Level Monitoring

Standpipe ID	Change in Groundwater Elevation between last and first measurements of monitoring year (ft)	2023-2024 Average Groundwater Elevation (ft)	Change in Average Groundwater Elevation from Prior Monitoring Year (ft)	1991-2024 Historical Mean Groundwater Elevation (ft)	2023-2024 Average Groundwater Elevation from Historical Mean Groundwater Elevation (ft)
SI-5	+8.1	278.1	+11.8	272.8	+5.3
SI-8	Not Measured during FY 23/24				
SI-9	+1.4	222.5	+1.0	224.2	-1.7
SI-15	+3.9	267.2	+3.9	264.1	+3.1
SI-16	+2.2	225.1	+1.5	226.9	-1.7



2.1.3 RAMBLA PACIFICO

Two standpipes are in use for groundwater level monitoring in the Rambla Pacifico Area: SI-13 and SI-14. Table 5 summarizes the recorded measurements over the monitoring year and changes from historic water level averages for each standpipe. During the current monitoring year, water levels in SI-13 remained consistent until February 2024 when they increased by 3.9 feet through May 2024. Water levels in SI-14 remained consistent until January 2024, then increased by 5.3 feet through May 2024. Water levels in both standpipes remain elevated above levels prior to Winter of 2022-2023. The only district dewatering facility in the Rambla Pacifico Area is dewatering well W-K, which has been dry since 2015.

Table 5: Rambla Pacifico Area Water Level Monitoring

Standpipe ID	Change in Groundwater Elevation between last and first measurements of monitoring year (ft)	2023-2024 Average Groundwater Elevation (ft)	Change in Average Groundwater Elevation from Prior Monitoring Year (ft)	1991-2024 Historical Mean Groundwater Elevation (ft)	2023-2024 Average Groundwater Elevation from Historical Mean Groundwater Elevation (ft)
SI-13	+3.9	363.6	+4.8	359.0	+4.6
SI-14	+4.2	344.8	+2.5	342.1	+2.8

2.2 SLOPE INCLINOMETERS

2.2.1 SUMMARY OF SLOPE INCLINOMETER MONITORING EVENTS

Yeh surveyed a total of eleven out of twelve existing inclinometers during the monitoring year, Inclinometer SI-8 was not surveyed, and inclinometer SI-10 was only surveyed once in August 2023. Inclinometer locations are presented on Plate 1. Inclinometers are typically surveyed approximately quarterly or on an accelerated schedule depending on rainfall, seismic activity and the past and recent movement history. Inclinometers were surveyed using a vertical traversing probe that measures the tilt of the casing at 2-foot intervals. Inclinometer data were collected via Bluetooth onto a field tablet and processed by comparing each tilt measurement to previous surveys.

DigiPro2 software (Slope Indicator, 2014) was used for inclinometer data processing and presentation utilizing a post Q1 2021 survey as a baseline (unless otherwise noted). Appendix B includes plots of cumulative change and incremental change in the A and B directions for each inclinometer surveyed during the monitoring year. The plots in Appendix B also provide annotated construction details and notes of interpreted past and current movement, as



applicable. Slope inclinometers SI-5, SI-9 and SI-16 measured displacement between surveys and SI-12 measured possible displacement.

Inclinometer survey results for each of the three Calle del Barco areas are summarized below:

2.2.2 RAMBLA VISTA

Three inclinometers are currently monitored within the Rambla Vista Area: SI-4, SI-7 and SI-10. The inclinometers did not display discernable shear-type movement over the monitoring year. Inclinometers SI-4 and SI-10 both displayed depth positioning errors in the B direction.

Casing deformation in SI-10 above approximately 12 feet is impeding smooth advancement of the traversing probe, which is potentially damaging to the probe sensors. The existing deformation at that depth may be the result of previous roadway construction in 1999 that involved replacement of the upper part of the casing. SI-10 will no longer be surveyed after August 23, 2023 and is earmarked for replacement.

2.2.3 CALLE DEL BARCO

There are seven inclinometers located in the Calle del Barco Area: SI-5, SI-8, SI-9, SI-11, SI-15 and SI-16. SI-8 was not surveyed during the monitoring year due to lack of private property access. Of the six inclinometers surveyed, SI-5, SI-9 and SI-16 recorded movement and SI-12 recorded possible movement.

Inclinometer SI-5 measured approximately 0.19-inches of shear-type displacement at 36 to 38 feet and bearing 218-degrees which began approximately November 2023 with most occurring after February (Yeh, 2024). Between February and March 2024 approximately 0.14- inches of the displacement occurred and 0.05- inches occurred between March and May 2024 indicating that the movement had slowed. The depth and bearing of the movement is consistent with previously reported displacements between 1992 to 1995 and again in the 2004 to 2005 monitoring year.

Inclinometer SI-16 recorded ongoing, casing-lean type deformation above approximately 50-feet. A shear component with magnitude of approximately 0.05-inches to the Southwest developed at 48-feet after February 2024. Total accumulated displacement on SI-16 for the monitoring year was 0.1 inches.

Inclinometer SI-9 recorded ongoing, small, casing-lean type deformation above approximately 50-feet with a total accumulated displacement of approximately 0.1 inches over the monitoring year.



These findings are consistent with past monitoring of inclinometers SI-9 and SI-16, however because SI-9 and SI-16 have accumulated deformation at the depths of prior movement and creep rates that are probably below the margin of error for a traversing type probe, individual measurements cannot be quantified. In summary, approximately 0.1-inches of displacement can be inferred during 2023-2024 monitoring year with the majority occurring after February 2024. In-place monitoring devices could be beneficial to confirm the presence or absence of ongoing creep or small episodic deformation.

Inclinometer SI-12 measured 0.14-inches of possible displacement between 52 and 56 feet and bearing southwest. Depth and morphology of the deformation is consistent with previously reported movement, however since the changes occurred at the bottom of the casing there are an insufficient number of stable readings below the movement depths to quantify the interpreted magnitudes. Additionally, the bottom readings on some casings are unreliable and vulnerable to error caused by debris in the tracks, depth positioning due to infilling and other variables. Subsequent surveys of this casing seem to indicate error in the lower casing readings therefore this movement is reported as “possible” until further data is acquired. Rambla Pacifico

There are two inclinometers surveyed in the Rambla Pacifico Area; SI-13 and SI-14. Neither inclinometer displayed discernable shear displacement during the monitoring year.

Inclinometer SI-13 continues to display error in the upper 28 feet. Inconsistent cumulative displacement plots for SI-13 since the first survey following installation are probably the result of depth positioning error within a highly curved or kinked casing that occurred during or shortly after installation.

3. WATER BUDGET TRACKING

3.1 RAINFALL DATA

Yeh obtained rainfall data for the monitoring year from the Big Rock Mesa Rain Gauge #1239 operated by the Los Angeles County Department of Public Works (LADPW). Prior to 1984, rainfall data was obtained from the Carbon Canyon Rain Gauge #447C and after 1984 from the onsite Big Rock Mesa Rain Gauge #1239. For this report, a 40-year rainfall average of 16.44 inches from the Big Rock Mesa Rain Gauge is used as an annual average.

Plate 2 - Rainfall Graph displays historical monthly and water year annual rainfall from October 1968 through September 2024. Recorded rainfall over the monitoring year from July 1, 2023 to June 30, 2024 totaled 32.37 inches, which is 15.93 inches above the 40-year Big Rock Mesa Rain



Gauge running average of 16.44 inches. The recoded rainfall total for the water year from October 1, 2023, to September 30, 2024 totaled 27.92 inches.

This year was the second consecutive year of above average rainfall. The monitoring year's rainfall total of 32.37 inches was the most recorded since 2005. The monthly total for February 2024 of 14.88 inches was the most recorded in a month since 17.0 inches was recorded at the Carbon Canyon Rain Gauge in February of 1998.

Plate 4 – Discharge Rates vs Rainfall Totals presents rainfall deviation from the 40-year mean and compares rainfall amounts to total dewatering output.

3.2 DEWATERING

Yeh tracks dewatering production for the pumping dewatering wells installed throughout the assessment district and the horizontal gravity drains (hydraugers) installed along Rambla Orienta and at the toe of the landslide. The combined dewatering production for the monitoring year averaged 1,112 gallons per day (gpd), which is an increase of 82-percent from the previous monitoring years' average production of 610 gpd and was the highest annual average dewatering production since the 2015-2016 monitoring year. The dewatering production increased with above average rainfall from December through March. Approximately 69-percent of the total dewatering production was pumped from dewatering wells and 31-percent was generated from hydraugers.

3.2.1 DEWATERING WELL PRODUCTION

Yeh performed monthly monitoring of production for the 11 active dewatering wells. Well production is measured approximately monthly for each well by reading flow totalizers that are installed along the discharge line. A summary of well production and well status is presented in Appendix C. A plot for historical production and a plot for monitoring year production vs daily rainfall for each individual well are included in Appendix C. A graph showing total dewatering production since 1992 is included on Plate 3 and total production vs daily rainfall for the monitoring year is included on Plate 4.

Average monthly total well production for the monitoring year was 769 gpd which is 196-percent higher than last year's average production of 393 gpd, 146-percent more than the historical production average of 525 gpd calculated from 1992 to present. This monitoring years' annual average well production was the highest since the 2012-2013 monitoring year with April 2024 recording the highest monthly average dewatering production since June 2011.



Well production typically varies in response to rainfall conditions. The dewatering well production increase over this monitoring year is consistent with the high rainfall totals.

3.2.2 HYDRAUGER PRODUCTION

Hydrauger production is measured directly from a sampling port installed along each hydrauger casing where it daylights at the slope face. Yeh performed monthly monitoring to measure flow from 11 hydrauvers. Two locations, HD-13 and H-1, have recorded consistent flow in recent years. Hydrauger H-2A flows intermittently in response to rainfall. Production data and status for individual hydrauvers is included in Appendix C. A graph showing total hydrauger production since 1992 is presented on Plate 3.

The average monthly hydrauger production over the monitoring year was 343 gpd which is 158-percent more than last year's average monthly production of 217 gpd and 150-percent more than the historical average production of 229 gpd calculated from 1992 to present. The values recorded during the monitoring year are 25 percent less than the maximum average annual production of 455 gpd recorded during the 1996-1997 monitoring year.

Hydrauger production typically varies in response to rainfall conditions. The increase in average hydrauger production over this monitoring year from the previous monitoring year is primarily due to an increase in production at H-2A.

4. SEISMIC EVENTS SUMMARY

Eight earthquakes with a magnitude of 4.0 or greater were recorded within a 100-mile radius of the project area (See Figure 2). Earthquake magnitudes ranged from M4.09 to M5.08 with epicentral distances ranging from 17 to 80 miles. The largest event was reported as M5.08 that occurred August 20, 2023 and was located 40 miles to the northwest, near Ojai, CA.

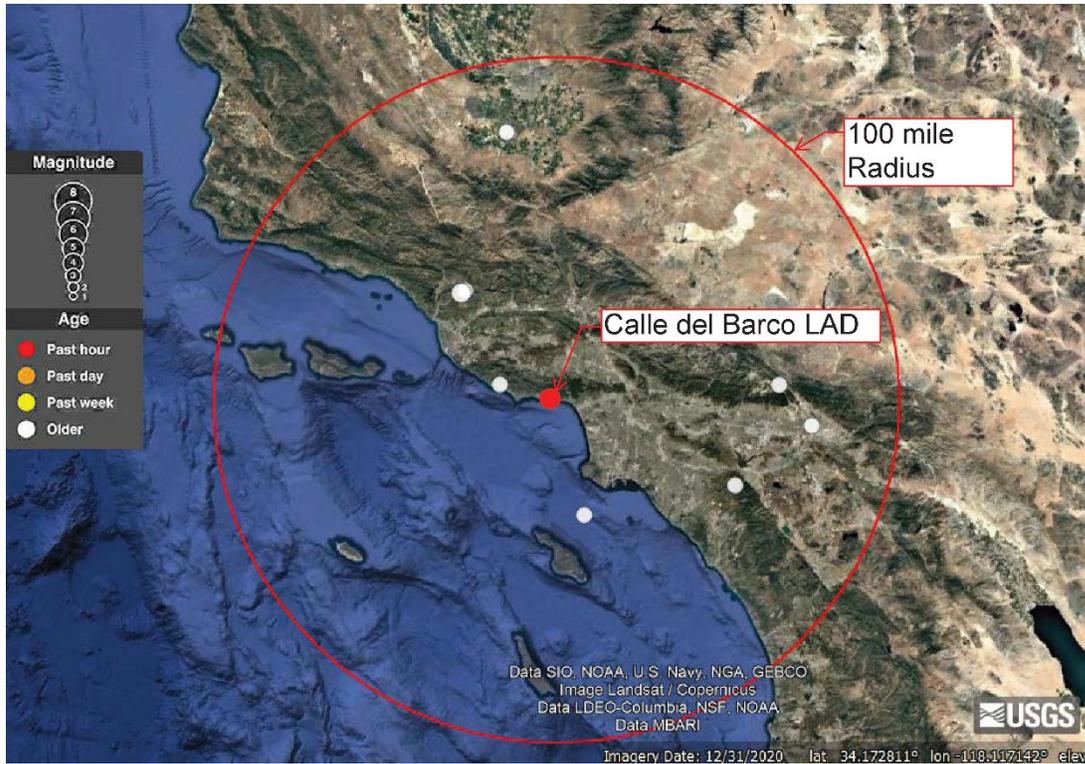


Figure 2: M4.0+ earthquakes within 100-miles of Calle del Barco LAD between 7/1/2023 and 6/30/2024

Yeh personnel performed post-earthquake observations and measurements that included surveying of key inclinometers and/or field observations of the ground surface made during scheduled monitoring and maintenance before and after the earthquake events. Measured movement from inclinometer surveys discussed in Section 2.2 of this report do not necessarily appear to be attributed to seismic activity. Yeh staff did not observe surface displacements related specifically to the earthquakes and is unaware of any reports of damage local to the Calle del Barco Landslide AD resulting from the earthquakes.

5. MAINTENANCE AND CAPITAL IMPROVEMENTS

Table 4 summarizes the maintenance and capital improvement activities performed over the monitoring year. Typical maintenance activities to dewatering wells include assessing and replacing or repairing dewatering well pumps, well electronics and well controls. Typical maintenance to hydraugers included PVC repairs within the conveyance piping and discharge locations. Capital improvements include replacement and rehabilitation of existing facilities and special projects to improve the monitoring and maintenance capabilities.

Table 4: Summary of Facility Maintenance and Improvements

Dates Noted	Maintenance Item Description	Assessment	Status
Intermittent following rainfall	The lower hydrauger cluster HD-11, 12, and 13 has been repeatedly buried following rainfall	Yeh observes the over steepened soil slope above the hydrauger cluster repeatedly buries the sampling ports	Hydraugers are excavated by hand each time.
9/30/2023	Vault Cover W-K damaged	Yeh - Observation hatch from W-K vault cover partially detached. Vault is in the traffic lane so vault cover needs to be replaced	9/30/23- Yeh replaced damaged vault cover with temporary plate. 12.22.23- Yeh replaced vault cover with new vault cover without observation hatch.
2/8/2024	Post storm well function assessments	Yeh – check production, amps and volts at all wells following major rain event February 1 -6, 2024.	All wells operating normally
2/23/2024	Post storm well function assessments	Yeh – check production, amps and volts at all wells following major rain event of February 18-21, 2024 and February 9, 2024 EQ	All wells operating normally
Spring 2024	CIP Materials	Procure shape array instrumentation and equipment materials to install in SI-9	Installation was performed in September 2024 and is operational. Details will be provided in FY24/25 Report.

6. ADDITIONAL OBSERVATIONS AND MONITORING

The following additional field observations were made by Yeh staff over the monitoring year that will continue to be considered and tracked for future improvement projects.

- Rainfall totals for the 2023-2024 monitoring year were the highest since the 2004-2005 monitoring year.
- Water levels remain elevated relative to the area average described in Section 2.1. The increase is a result of two years of above average rainfall.
- Surficial erosion was noted within the Assessment District boundaries during and after the intermittent rain events between December and May and include:
 - Rambla Orienta at the east end of the soldier pile wall;
 - Fronting the residence at 3958 Rambla Vista; and
 - Slopes above the Calle del Barco cul-de-sac.

7. CAPITAL IMPROVEMENTS AND SPECIAL PROJECTS

7.1 WORK IN PROGRESS

The following capital improvement and special projects have been estimated and are in planning and implementation phases.

- Install in-place sensors across known zones of displacement within inclinometers SI-9 and SI-16. Materials and instrumentation was procured and will be installed during next fiscal year.

7.2 FUTURE IMPLEMENTATION

The following improvement projects have been identified and are being tracked and planned for future consideration.

- A modern form of repeatable surface survey should be re-introduced and continued for the project as a consistent means to observe and evaluate potential land movement throughout the extent of the assessment district area and more specifically in-between inclinometer casing locations.
- Replace inclinometer SI-10, install new inclinometer with a vibrating wire piezometer and a time domain refractometry cable.
- Install replacement hydraugers near the toe of the landslide to replace hydraugers that are dry, repeatedly damaged, and vulnerable to being buried by soil and rock debris
- Upgrade dewatering well flow meters with near real-time data transmission capability.

8. REFERENCES

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_____ (2008), 'Annual Report, July 2007 through June 2008, Calle Del Barco Landslide Assessment District, Malibu, California,' dated October.

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_____ (2005), 'Annual Report, July 2004 through June 2005, Calle Del Barco Landslide Assessment District, Malibu, California,' dated October.

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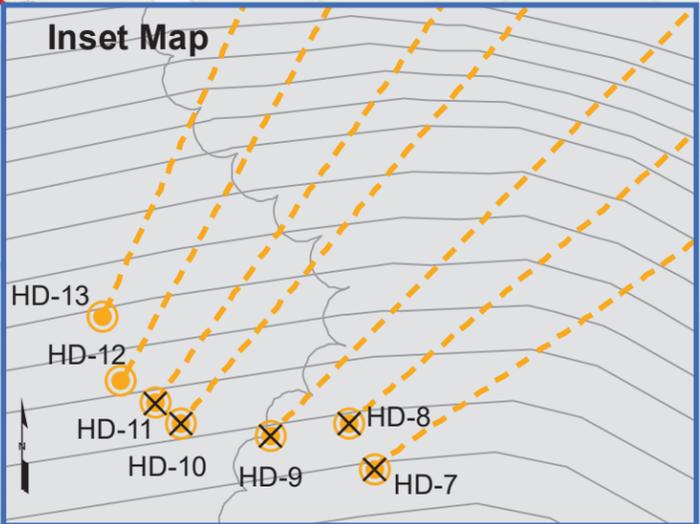
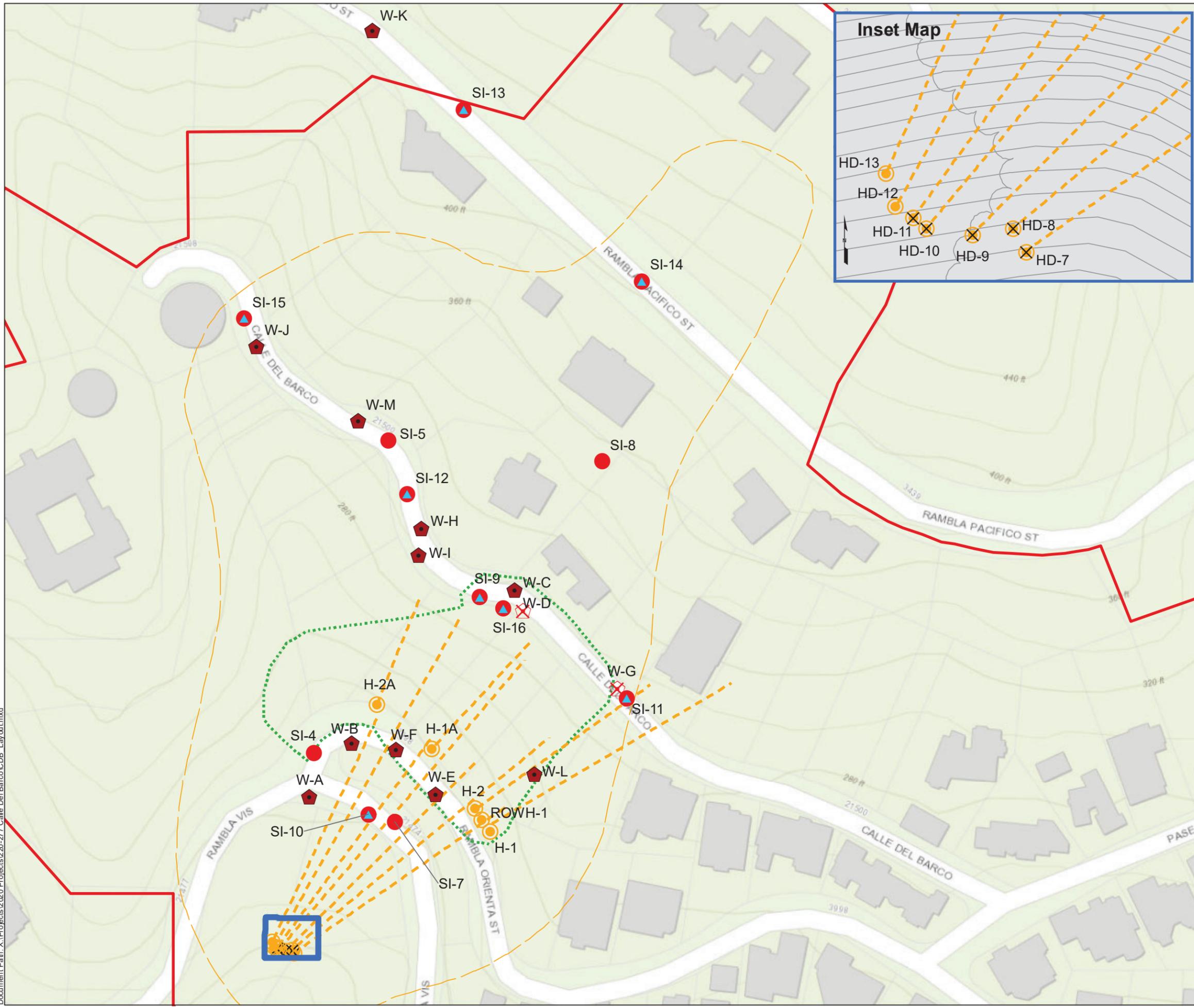


Assessments Calle Del Barco Landslide Assessment District, Malibu, California," dated March 14, 2024.



**CALLE DEL BARCO LANDSLIDE
ASSESSMENT DISTRICT
MALIBU, CALIFORNIA
MONITORING INSTRUMENTATION
AND
DEWATERING FACILITIES MAP**

Yeh and Associates, Inc.
Geotechnical • Geological • Construction Services

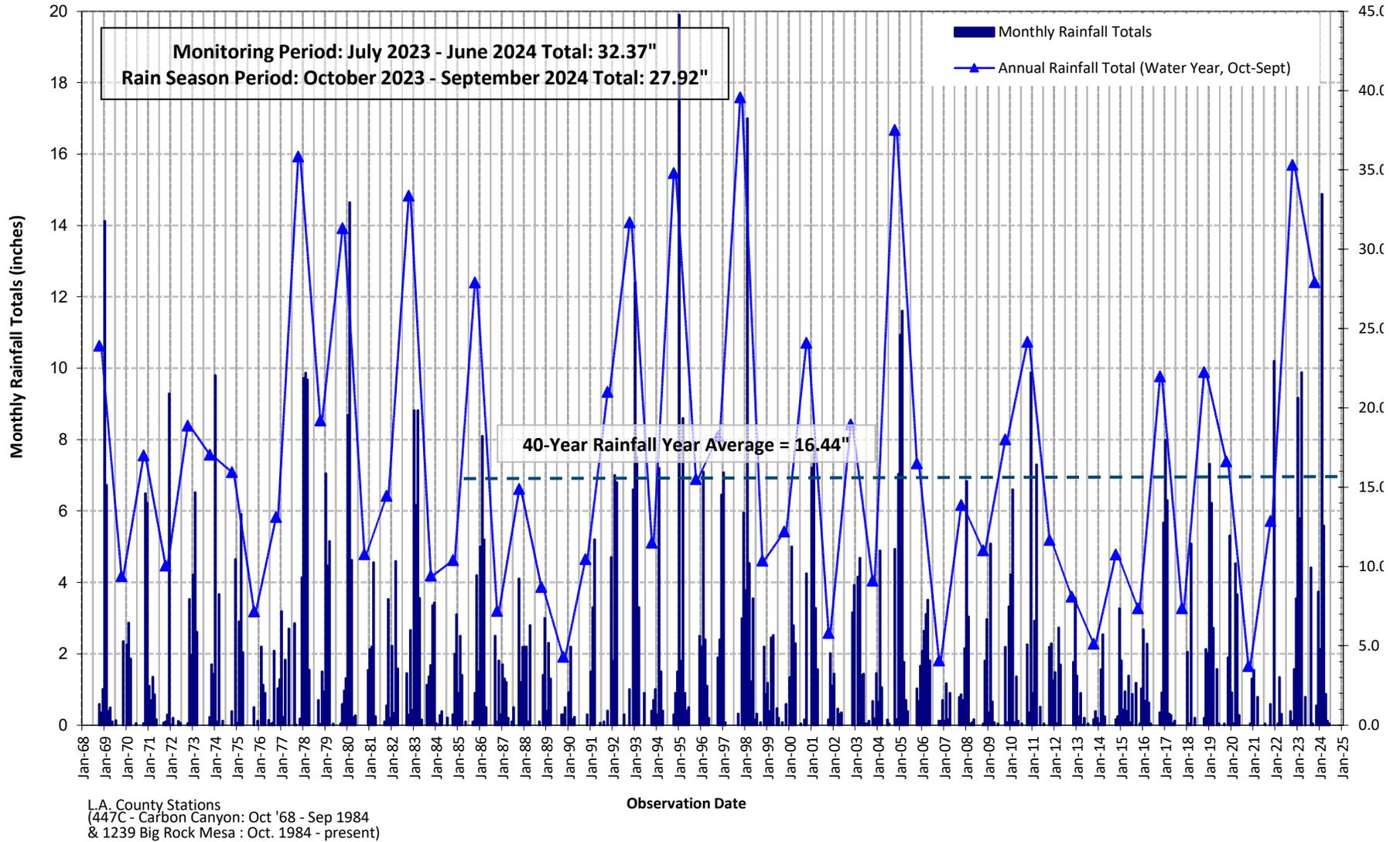


- Active Dewatering Well
- Inactive Dewatering Well
- Slope Inclinometer/Standpipe Piezometer
- Pneumatic Piezometers
- Nonproducing Hydrauger
- Producing Hydrauger
- Hydrauger Installed Length
- District Boundary
- Approximate Limits of Deep Seated Landslide
- Approximate Limits of 1998 Shallow Slope Failure (BYA, 1999)



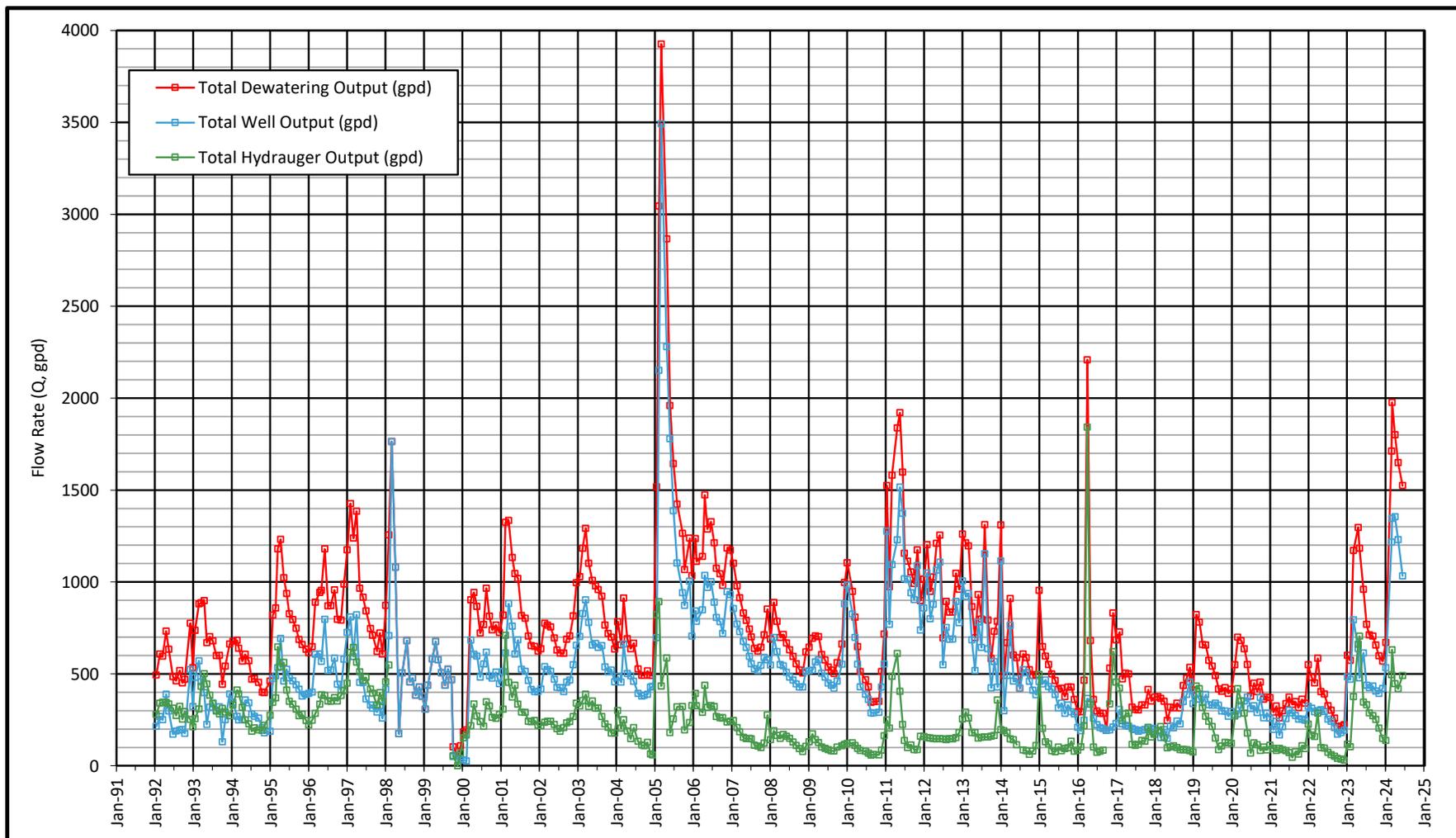
DATE: 10.21.23	PROJECT NUMBER: 220-277	PLATE: Plate-1
DRAWN BY:	APPROVED BY:	

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RAINFALL GRAPH

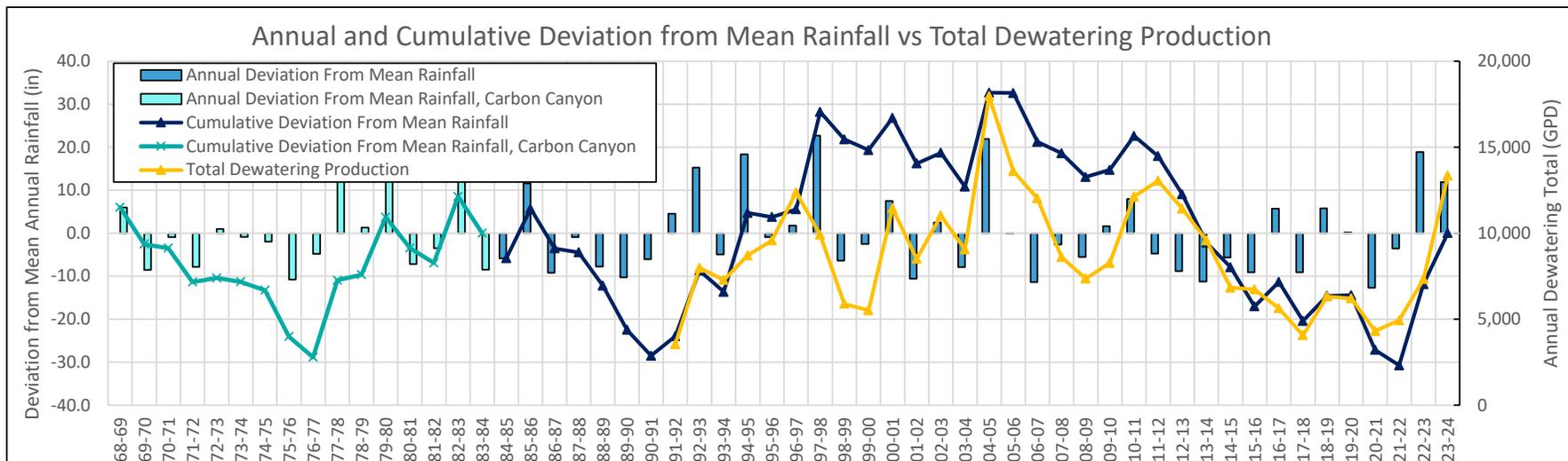
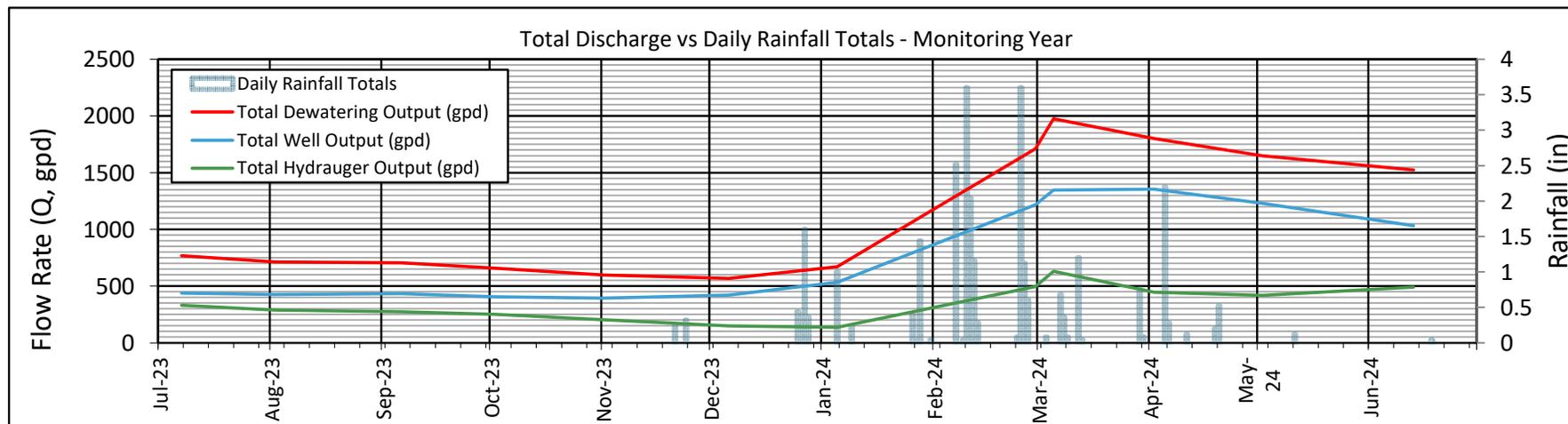
Calle del Barco Landslide Assessment District
 Malibu, California



TOTAL DISCHARGE - WELLS AND HYDRAUGERS (HISTORIC)

Calle del Barco Landslide Assessment District

Malibu, California



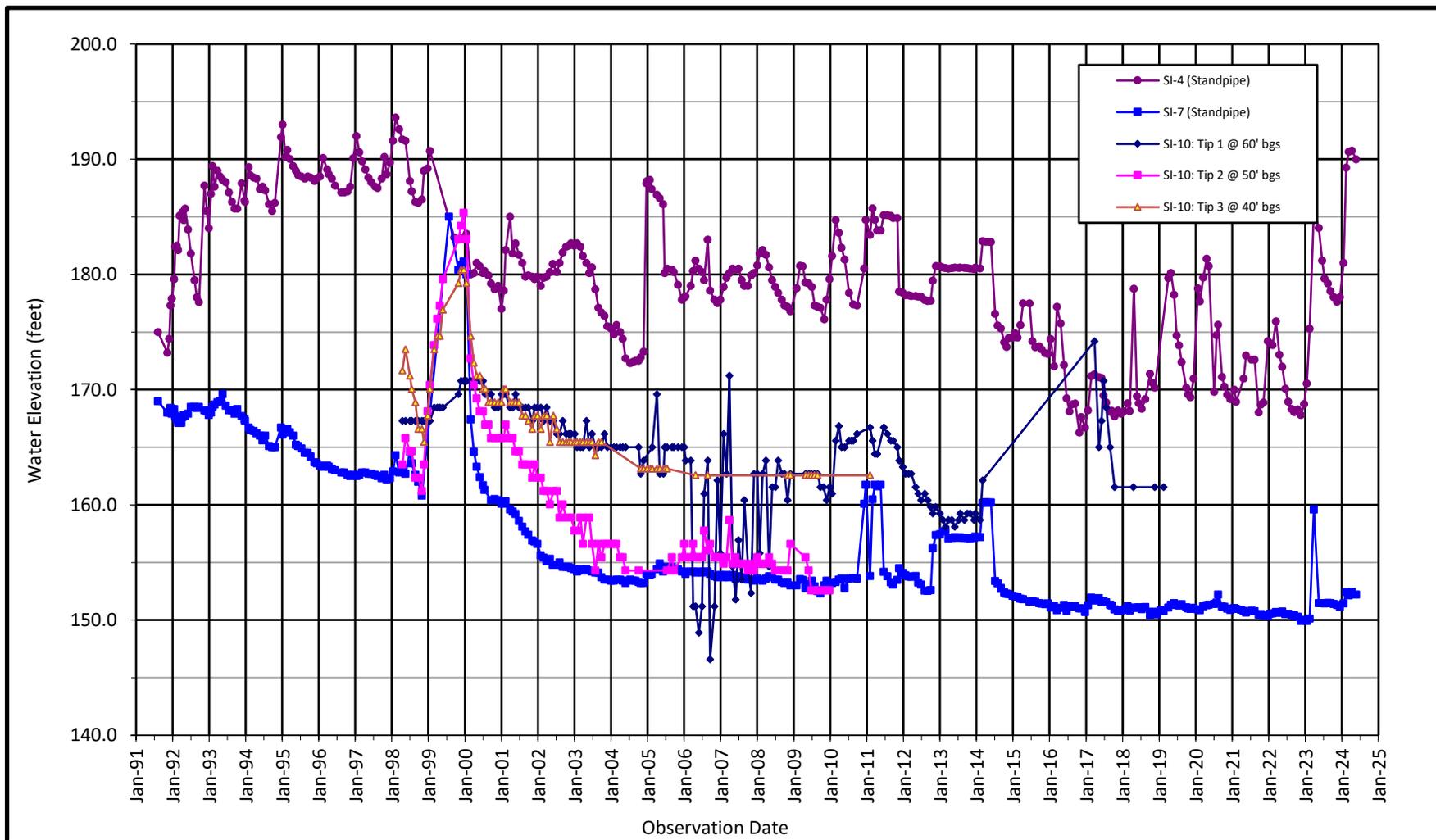
DISCHARGE RATES VS RAINFALL TOTALS
 Calle del Barco Landslide Assessment District
 Malibu, California

APPENDIX A - GROUNDWATER LEVELS

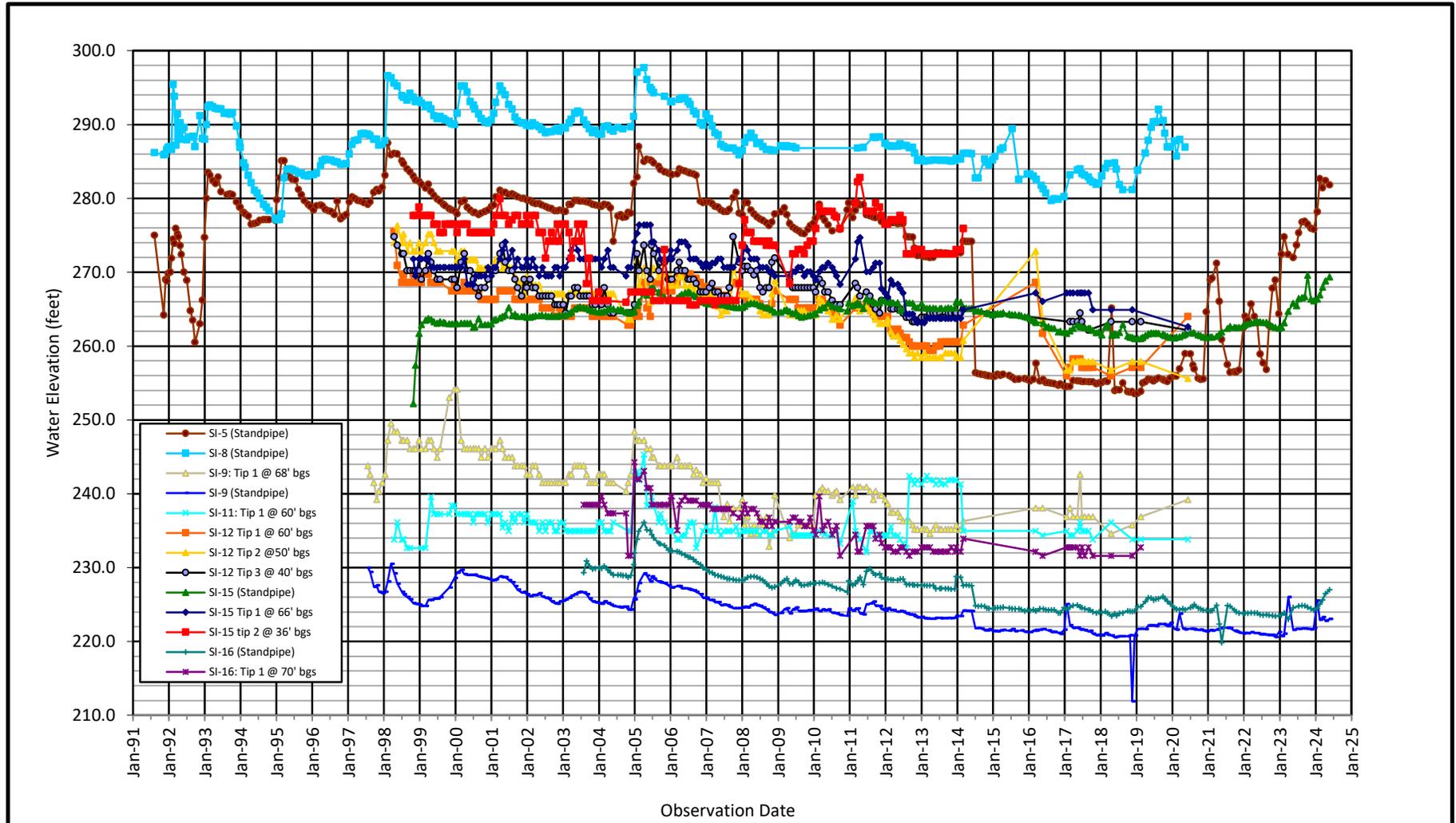
CALLE DEL BARCO LAD - Standpipe Piezometer Information					
Standpipe ID	Reference Elevation (ft)	Casing Depth (ft)	Perforation Interval (ft)	Installed By	Notes
SI-4	207.0	81.0	Unknown	Unknown	
SI-5	302.0	100.0	Unknown	Unknown	
SI-7	201.0	106.0	Unknown	Unknown	
SI-8	352.0	131.0	Unknown	Unknown	
SI-9	298.0	100.0	Unknown	Unknown	
SI-13	424.0	82.0	75-80	BYA	
SI-14	408.0	80.0	73-78	BYA	
SI-15	301.0	78.0	71-76	BYA	
SI-16	297.0	90.0	Unknown	Unknown	

CALLE DEL BARCO LAD - Pneumatic Piezometer Information						
Piezometer ID	Tip No.	Reference Elev. (ft)	Tip depth (ft)	Tip Elev. (ft)	Installed By	Notes
SI-9	1	298	68	230	BYA	functioning as of 2020
	2 ^a		38	260	BYA	0 PSI as of 2020
SI-10	1	202	60	142	BYA	functioning as of 2020
	2*		50	152	BYA	blocked air line
	3 ^a		40	162	BYA	0 PSI as of 2020
	4 ^a		20	182	BYA	0 PSI as of 2020
SI-11	1	291.5	60	231.5	BYA	functioning as of 2020
	2		50	241.5	BYA	functioning as of 2020
	3*		40	251.5	BYA	air line leak
	4*		20	271.5	BYA	blocked air line
SI-12	1	301	60	241	BYA	functioning as of 2020
	2		50	251	BYA	functioning as of 2020
	3 ^a		40	261	BYA	functioning as of 2020
	4*		20	281	BYA	0 PSI as of 2020
SI-13	1 [*]	424	70	354	BYA	readings <0.3PSI as of 2020
	2 [*]		50	374	BYA	above water level since installation
SI-14	1	408	68	340	BYA	functioning as of 2020
	2		48	360	BYA	above water level since installation
SI-15	1	301	66	235	BYA	functioning as of 2020
	2*		36	265	BYA	non functioning
SI-16	1	297	70	227	BYA	functioning as of 2020
	2		40	257	BYA	functioning as of 2020

* - Piezometer not functioning
^a - functionality not certain

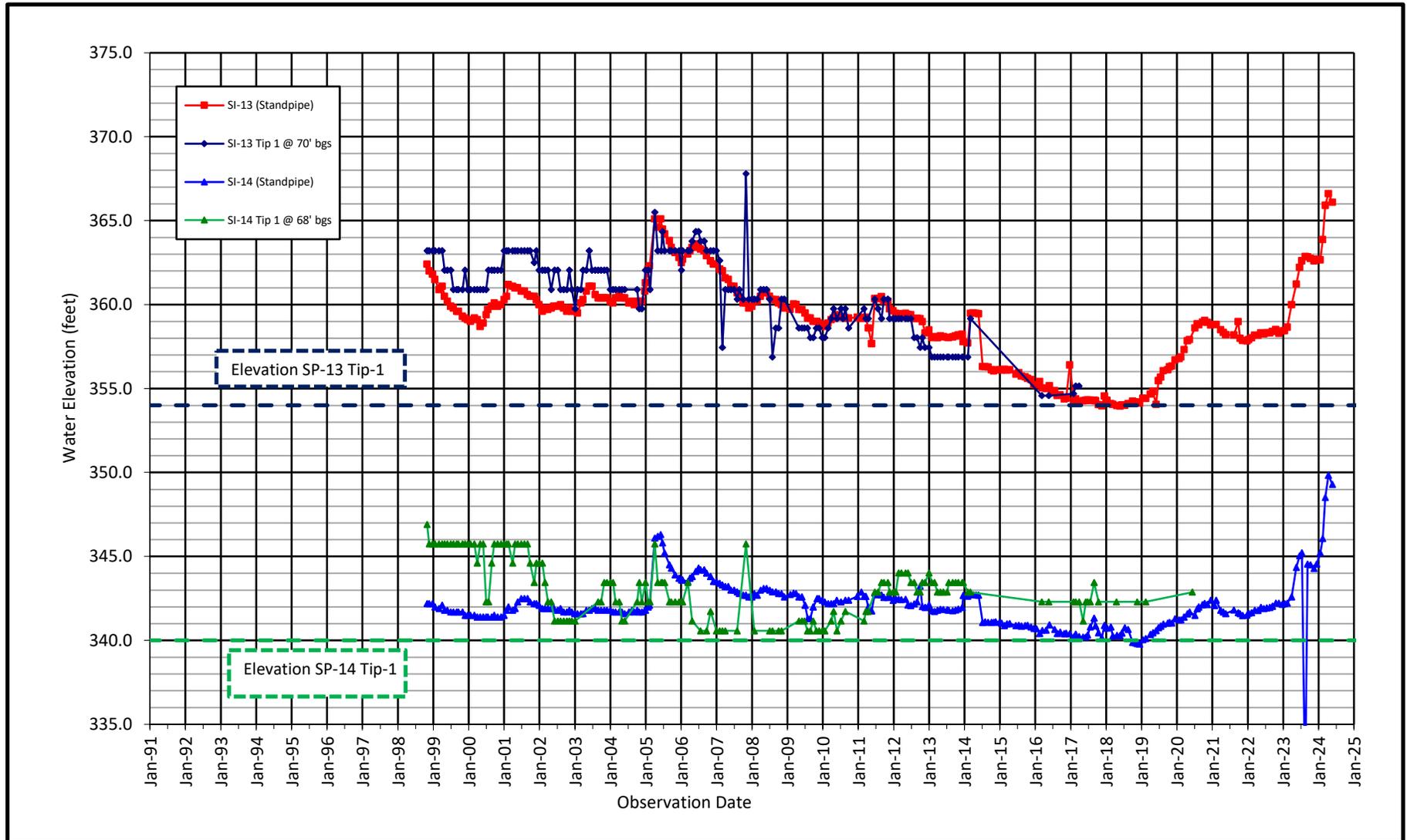


GROUNDWATER HYDROGRAPH
Rambla Vista
Calle del Barco Landslide Assessment District
Malibu, California



GROUNDWATER HYDROGRAPH

Calle del Barco
 Calle del Barco Landslide Assessment District
 Malibu, California



GROUNDWATER HYDROGRAPH

Rambla Pacifico

Calle del Barco Landslide Assessment District
Malibu, California

APPENDIX B - SLOPE INCLINOMETERS

Slope Inclinerometer Interpretation Summary																	
	SI-1*	SI-1A	SI-2**	SI-3	SI-4	SI-5	SI-6	SI-7	SI-8	SI-9	SI-10	SI-11	SI-12	SI-13	SI-14	SI-15	SI-16
Installation Details																	
Surface Elev. (ft) 4/00	295.0	297.0	298.0	207.0	206.0	302.0	295.0	200.0	335.0	298.0	202.0	291.5	301.0	405.0	398.0	304.0	295.0
Original DEPTH (ft.)	64.0	NI	NI	NI	76.0	100.0	NI	100.0	130.0	100.0	60.0	60.0	60.0	80.0	78.0	76.0	88.0
Current DEPTH (ft.)	64.0	NI	NI	NI	78.0	96.0	NI	102.0	130.0	96.0	62.0	57.0	56.0	78.0	76.0	72.0	86.0
STATUS	D	D	D	D	F	F	D	F	F	F	F	F	F	F	F	F	F
READING INTERVAL	N/A	N/A	N/A	N/A	Semi	Semi	N/A	Semi	Semi	Qrtly	Semi	Semi	Semi	Semi	Semi	Semi	Qrtly
DATE OF INSTALLATION	NI	NI	NI	NI	NI	NI	NI	NI	NI	NI	3/13/98	3/12/98	3/12/98	9/1998	9/1998	9/1998	8/8/03
DATE FIRST BASE READING	NI	NI	NI	NI	NI	NI	NI	NI	NI	12/22/97	3/16/98	3/13/98	3/16/98	10/12/98	10/12/98	10/23/98	8/13/03
DEPTH of MOVEMENT (ft)***	NI	NI	NI	NI	17-22	0-10, 36-38	15.0	40.0	15-17	53, 44	35-38	0-55	54	0-30	8.0	0-25, 77	46, 87
A+ Axis orientation	NI	NI	NI	NI	0	38.0	NI	28.0	22.0	212.0	244.0	258.0	238.0	210.0	224.0	190.0	210 est.
Interpretation Movement (inches)																	
2023-2024	NR	NR	NR	NR	--	0.19	NR	--	NR	0.1	--	--	0.14	--	--	--	0.1
2022-2023	NR	NR	NR	NR	--	--	NR	--	NR	--	--	--	--	--	--	--	--
2021-2022	NR	NR	NR	NR	--	--	NR	--	NR	--	--	--	--	--	--	--	--
2020-2021	NR	NR	NR	NR	--	--	NR	--	NR	--	--	--	--	--	--	--	--
2019-2020	NR	NR	NR	NR	--	--	NR	--	0.1	0.2	--	--	--	--	--	--	--
2018-2019	NR	NR	NR	NR	0.1	--	NR	--	--	--	--	--	--	--	--	--	--
2017-2018	NR	NR	NR	NR	--	--	NR	--	--	--	--	--	--	--	--	--	--
2016-2017	NR	NR	NR	NR	--	--	NR	--	--	--	--	--	--	--	--	--	<0.1
2015-2016	NR	NR	NR	NR	--	<0.05	NR	--	--	0.2	--	--	--	--	--	--	--
2014-2015	NR	NR	NR	NR	--	0.1	NR	--	--	--	--	--	--	--	--	--	<0.1
2013-2014	NR	NR	NR	NR	--	0.1	NR	--	--	--	--	--	--	--	--	--	<0.1
2012-2013	NR	NR	NR	NR	--	0.1	NR	--	--	0.15	0.1	--	0.1	--	--	--	0.2
2011-2012	NR	NR	NR	NR	--	--	NR	<0.05	0.1	0.15	--	0.2	--	--	--	0.1	0.35
2010-2011	NR	NR	NR	NR	--	--	NR	<0.05	0.05	<0.05	--	--	--	--	--	--	--
2009-2010	NR	NR	NR	NR	--	--	NR	--	--	0.2	--	0.1	--	--	--	--	0.1
2008-2009	NR	NR	NR	NR	--	--	NR	NA	--	0.1	--	--	--	--	--	--	--
2007-2008	NR	NR	NR	NR	--	--	NR	--	--	0.1	--	--	--	--	--	--	--
2006-2007	NR	NR	NR	NR	--	<0.1	NR	--	--	0.2	--	--	--	--	0.2	--	0.2
2005-2006	NR	NR	NR	NR	--	--	NR	--	--	0.1	--	--	<0.1	--	0.15	--	0.1
2004-2005	NR	NR	NR	NR	--	0.45	NR	<0.1	0.1	0.5	--	<0.1	0.11	--	--	--	0.35
2003-2004	NR	NR	NR	NR	--	--	NR	--	--	--	--	--	--	--	--	--	NA
2002-2003	NR	NR	NR	NR	--	--	NR	--	--	--	--	--	--	--	--	--	NI
2001-2002	NR	NR	NR	NR	--	--	NR	--	--	NR	--	--	--	--	--	--	NI
2000-2001	NR	NR	NR	NR	--	--	NR	--	--	--	--	--	--	--	--	--	NI
1999-2000	NR	NR	NR	NR	--	--	NR	--	--	--	--	--	--	--	--	--	NI
1998-1999	NR	NR	NR	NR	--	0.16	NR	0.11	--	2.19	--	--	--	--	--	--	NI
1997-1998	NR	NR	NR	NR	0.22	0.4	NR	0.66	0.32	13	0.22	--	--	NI	NI	NI	NI
1996-1997	NR	NR	NR	NR	--	--	0.36	0.12	--	NI	NI	NI	NI	NI	NI	NI	NI
1995-1996	NR	NR	NR	NR	--	0.12	--	--	--	NI	NI	NI	NI	NI	NI	NI	NI

KEY:

D	Destroyed
F	Functioning
B	New baseline in 1999
NI	Not Installed
--	Shaded yellow to indicate inclinometer does penetrate basal rupture.
--	Shaded blue to indicate inclinometer does NOT penetrate basal rupture.
--	Shaded gray to indicate inclinometer is no longer monitored.

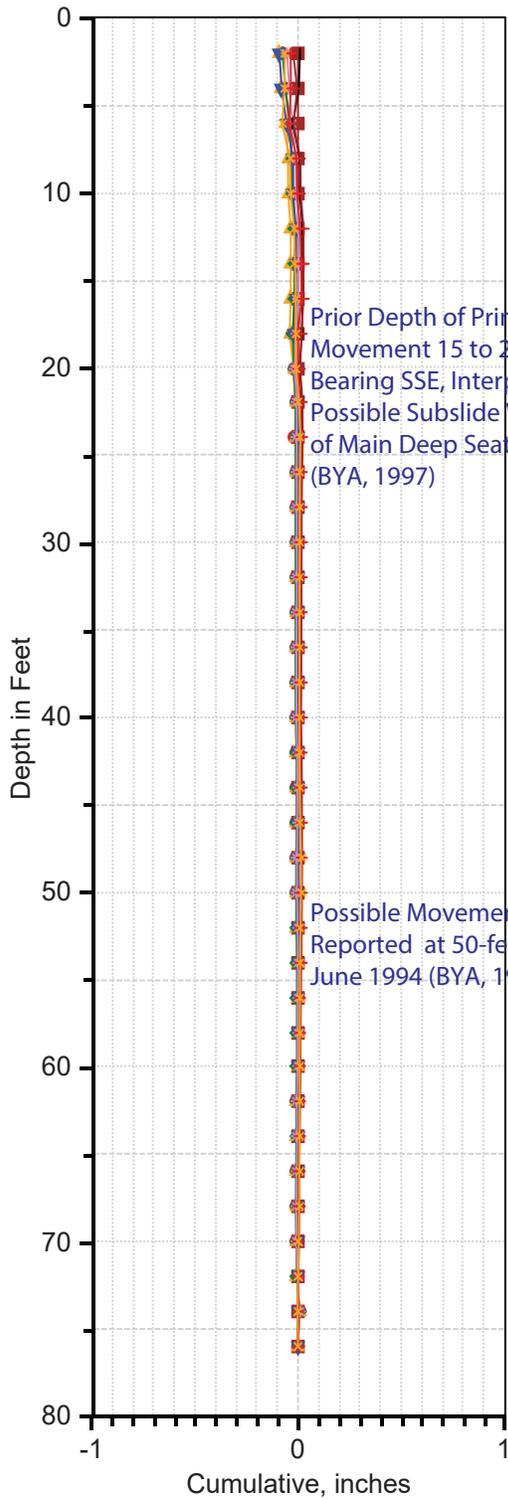
NOTES:

* Original SI-1 installed in 1978, and was destroyed.
SI-65 (installed in 1979) was renamed to SI-1
** Original SI-2 installed in 1978, and was destroyed.
SI-90 (installed in 1979) was renamed to SI-2

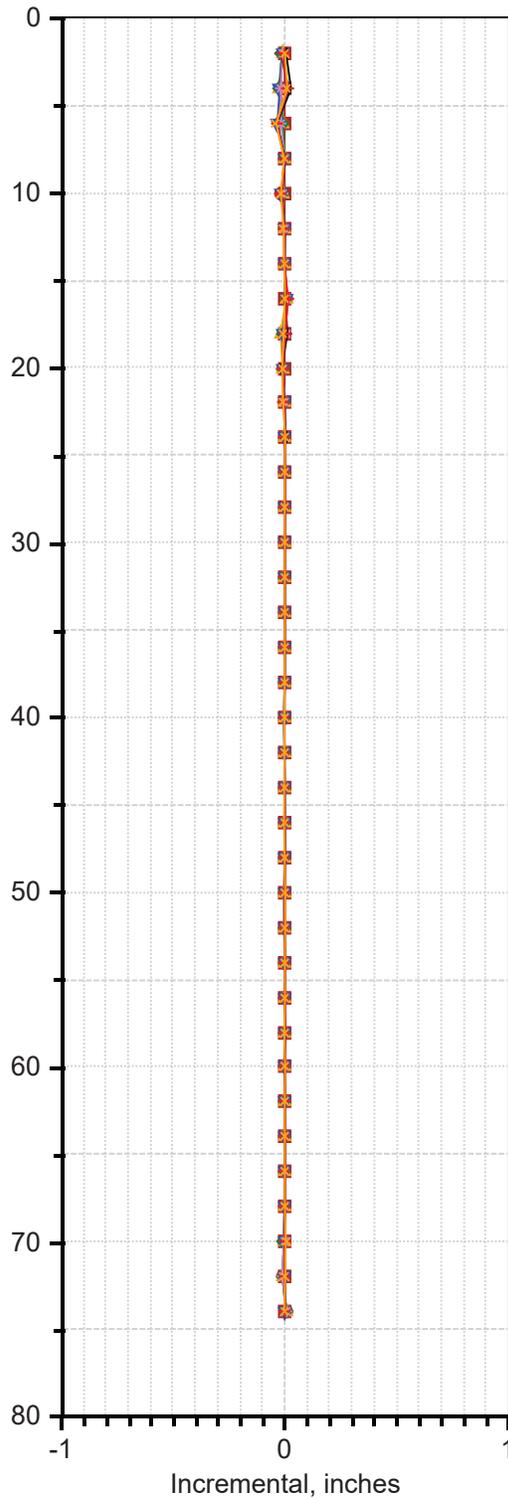
*** Referenced to current depth of SI (see note below)
**** SI-4, SI-7, and SI-10 were extended 6 feet upwards during reconstruction of the road in 1999 and interpretations are referenced to their current depth.

SUMMARY OF SLOPE INCLINOMETERS
Calle del Barco Landslide Assessment District
Malibu, California

A-
180°



A+
0°



- | | | |
|--------------|--------------|-------------|
| ■ 8/4/2021 | ● 12/15/2021 | ▲ 3/25/2022 |
| ◆ 5/18/2022 | ▼ 11/1/2022 | ◇ 1/19/2023 |
| ⊕ 11/14/2023 | ⊖ 2/13/2024 | ⊗ 3/28/2024 |
| ⊙ 5/2/2024 | | |

- | | | |
|--------------|--------------|-------------|
| ■ 8/4/2021 | ● 12/15/2021 | ▲ 3/25/2022 |
| ◆ 5/18/2022 | ▼ 11/1/2022 | ◇ 1/19/2023 |
| ⊕ 11/14/2023 | ⊖ 2/13/2024 | ⊗ 3/28/2024 |
| ⊙ 5/2/2024 | | |

Plot of Slope Inclinometer

SI-4

Plot Type: Cumulative and Incremental

Plot Direction: A-Direction

Depth of Survey (ft): 78

Baseline Date: 8/4/21

Corrections: None

Install Date: <9/1992

Installed Depth (ft): 76

Interpreted Movement Since Baseline (in): 0

Interpreted Movement Monitoring Year (in): 0



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PROJECT:

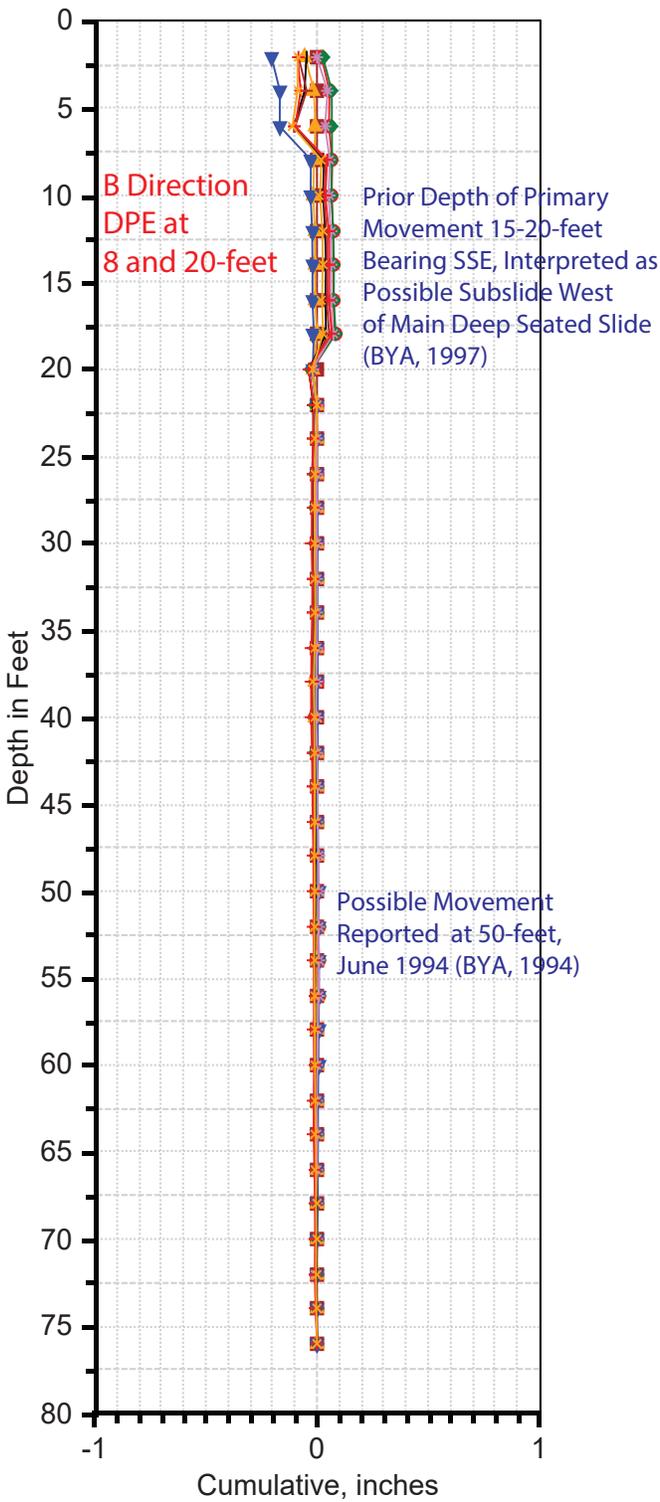
Calle del Barco LAD
Malibu, CA

PROJECT NUMBER:

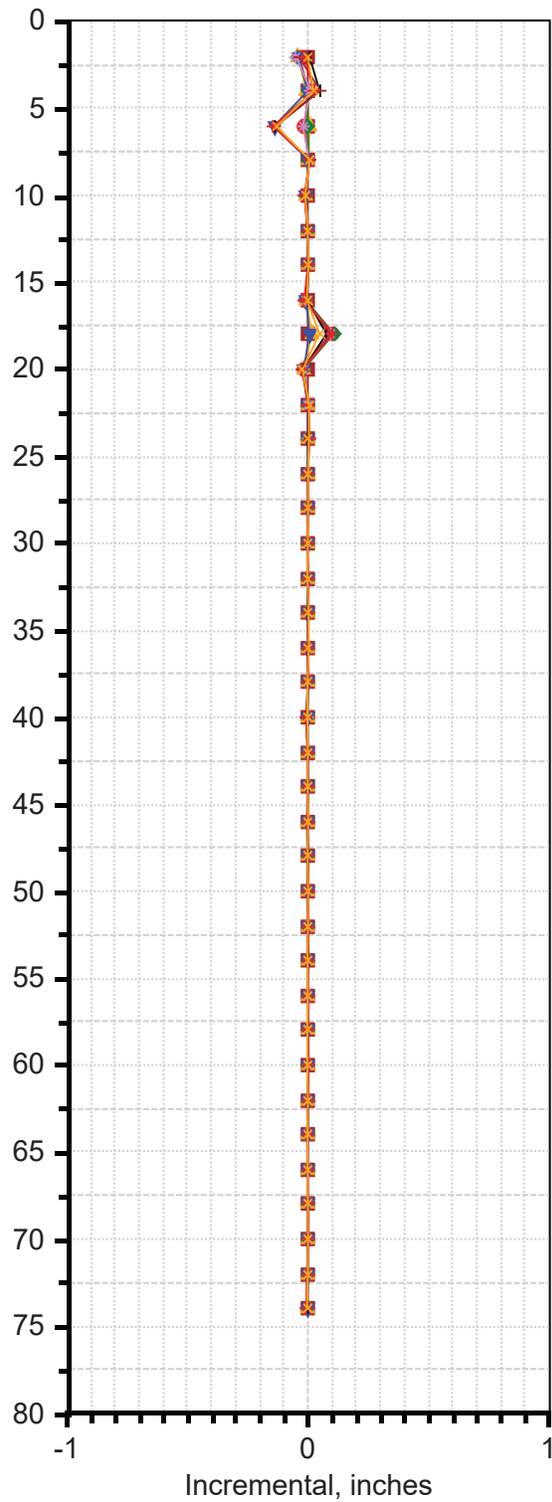
220-277

REVISION DATE: 3/13/2025

B-
270°



B+
90°



- 8/4/2021
- 12/15/2021
- ▲ 3/25/2022
- ◆ 5/18/2022
- ▼ 11/1/2022
- ◆ 1/19/2023
- 11/14/2023
- 2/13/2024
- 3/28/2024
- 5/2/2024

- 8/4/2021
- 12/15/2021
- ▲ 3/25/2022
- ◆ 5/18/2022
- ▼ 11/1/2022
- ◆ 1/19/2023
- 11/14/2023
- 2/13/2024
- 3/28/2024
- 5/2/2024

Plot of Slope Inclinometer

SI-4

Plot Type: Cumulative and Incremental

Plot Direction: B-Direction

Depth of Survey (ft): 78

Baseline Date: 8/4/21

Corrections: None

Install Date: <9/1992

Installed Depth (ft): 76

Interpreted Movement Since Baseline (in): 0

Interpreted Movement Monitoring Year (in): 0



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PROJECT:

Calle del Barco LAD
Malibu, CA

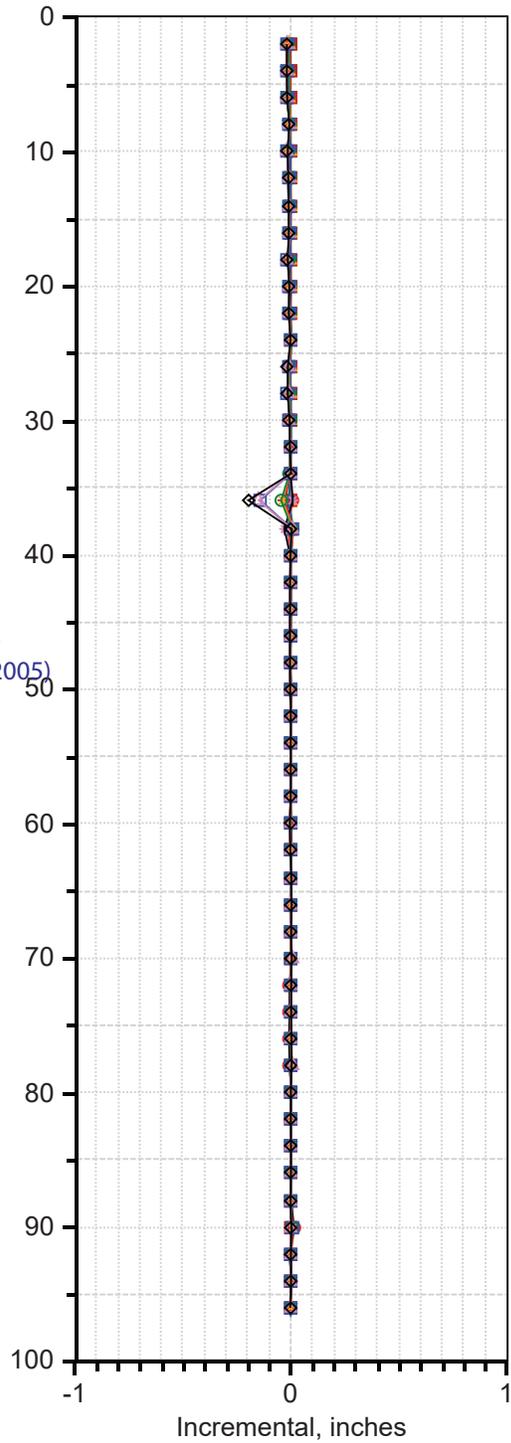
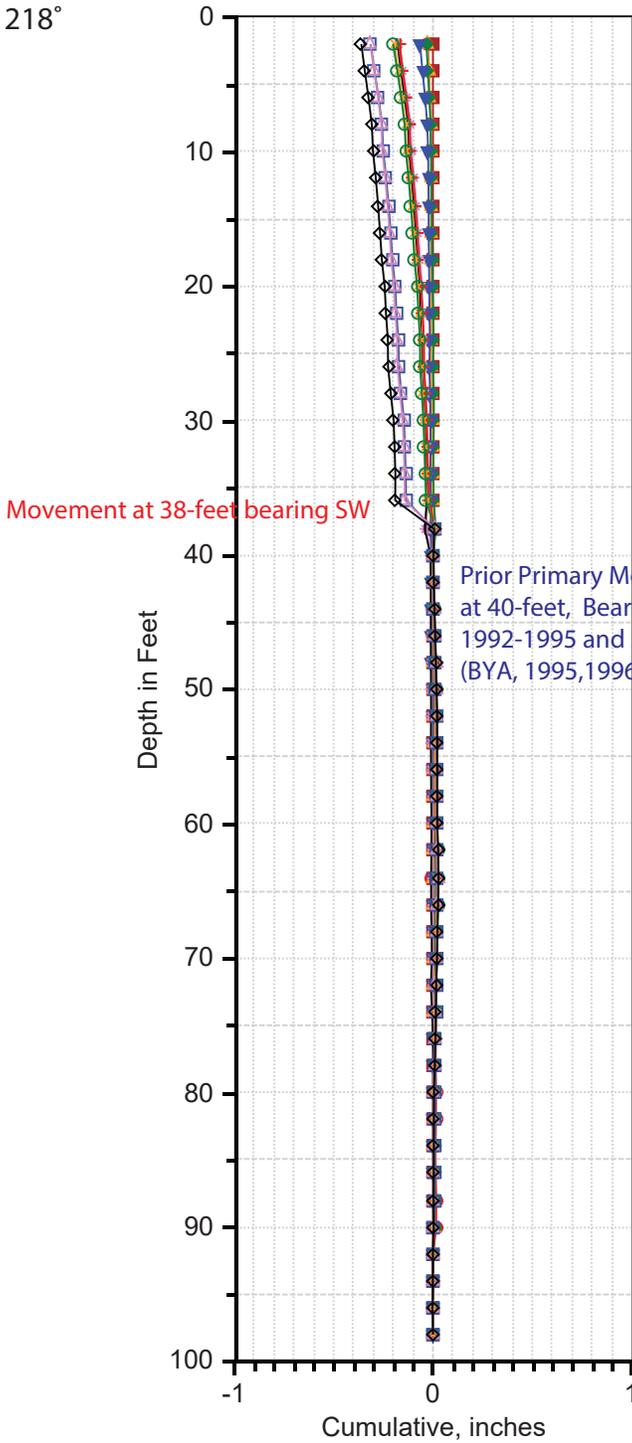
PROJECT NUMBER:

220-277

REVISION DATE: 3/13/2025

A-
218°

A+
38°



- 8/4/2021
- 11/1/2022
- 7/27/2023
- 2/8/2024
- 4/9/2024
- 12/9/2021
- 1/18/2023
- 9/14/2023
- 2/13/2024
- 5/2/2024
- 5/18/2022
- 6/7/2023
- 11/14/2023
- 3/28/2024

- 8/4/2021
- 11/1/2022
- 7/27/2023
- 2/8/2024
- 4/9/2024
- 12/9/2021
- 1/18/2023
- 9/14/2023
- 2/13/2024
- 5/2/2024
- 5/18/2022
- 6/7/2023
- 11/14/2023
- 3/28/2024

Plot of Slope Inclinometer

SI-5

Plot Type: Cumulative and Incremental		Plot Direction: A-Direction	
Depth of Survey (ft): 96	Baseline Date: 8/4/21	Corrections: None	
Install Date: <7/1992	Installed Depth (ft): 100	Interpreted Movement Since Baseline (in): 0.20	Interpreted Movement Monitoring Year (in): 0.19



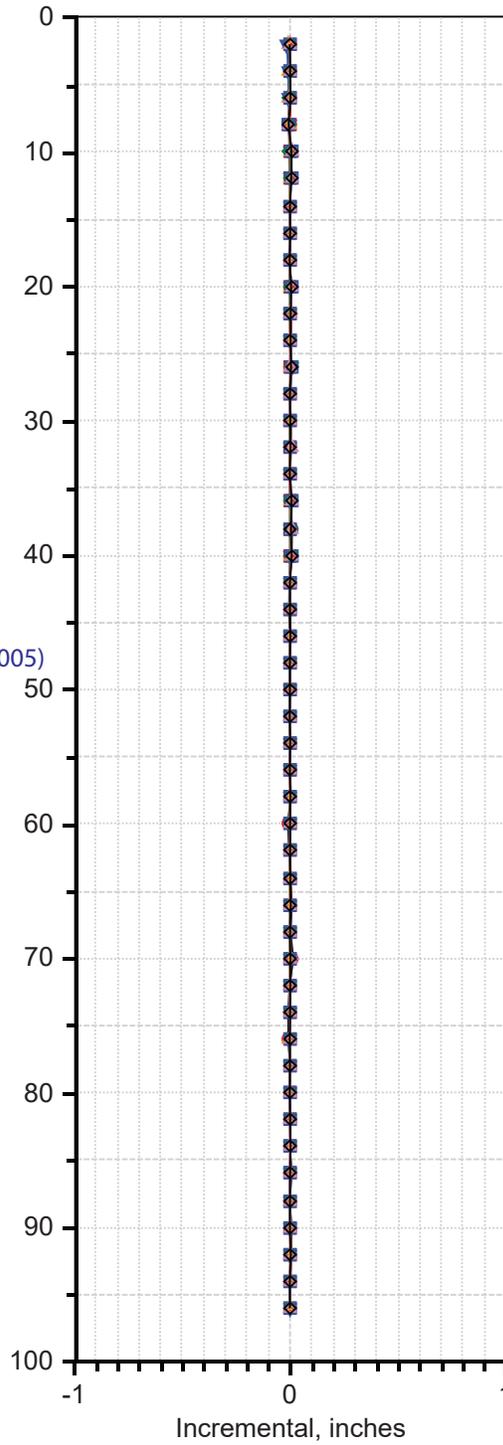
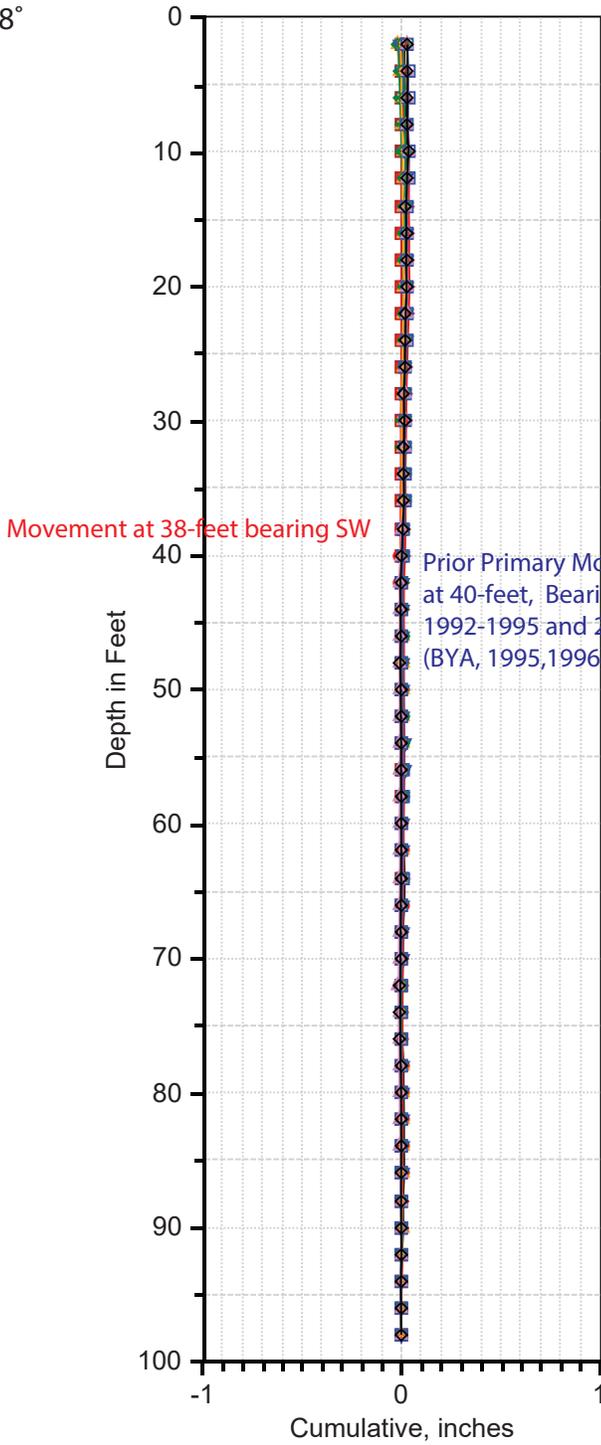
PROJECT: Calle del Barco LAD
Malibu, CA

PROJECT NUMBER:
220-277

REVISION DATE: 3/13/2025

B-
308°

B+
128°



- 8/4/2021
- 11/1/2022
- 7/27/2023
- 2/8/2024
- 4/9/2024
- 12/9/2021
- 1/18/2023
- 9/14/2023
- 2/13/2024
- 5/2/2024
- 5/18/2022
- 6/7/2023
- 11/14/2023
- 3/28/2024

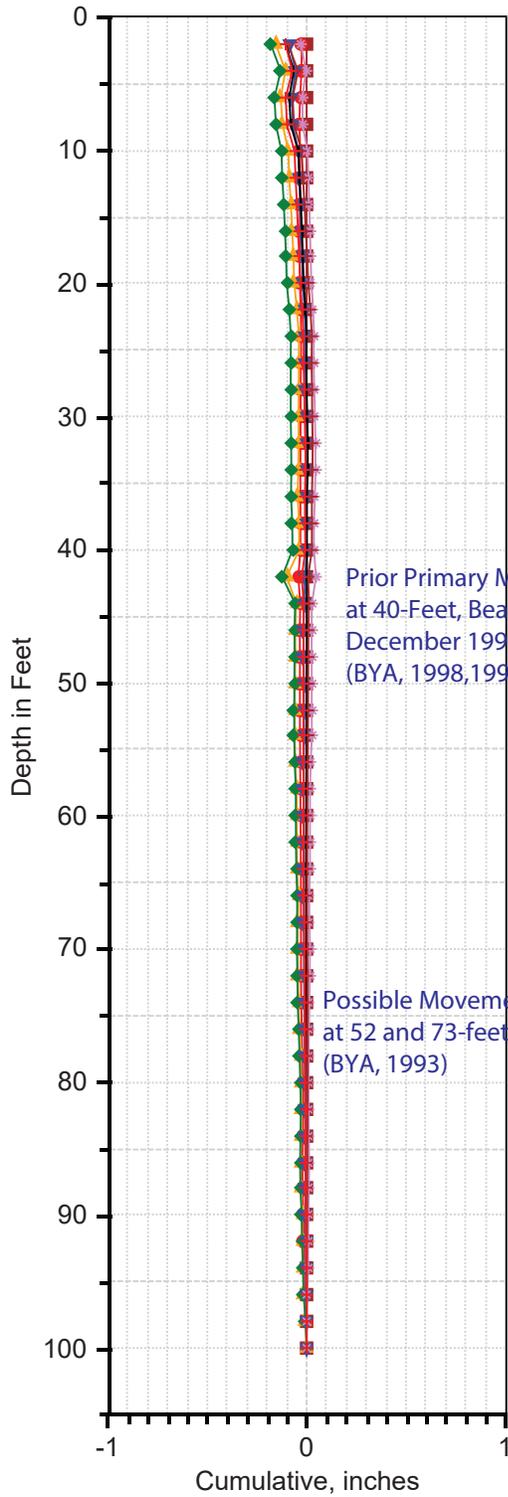
- 8/4/2021
- 11/1/2022
- 7/27/2023
- 2/8/2024
- 4/9/2024
- 12/9/2021
- 1/18/2023
- 9/14/2023
- 2/13/2024
- 5/2/2024
- 5/18/2022
- 6/7/2023
- 11/14/2023
- 3/28/2024

Plot of Slope Inclinometer

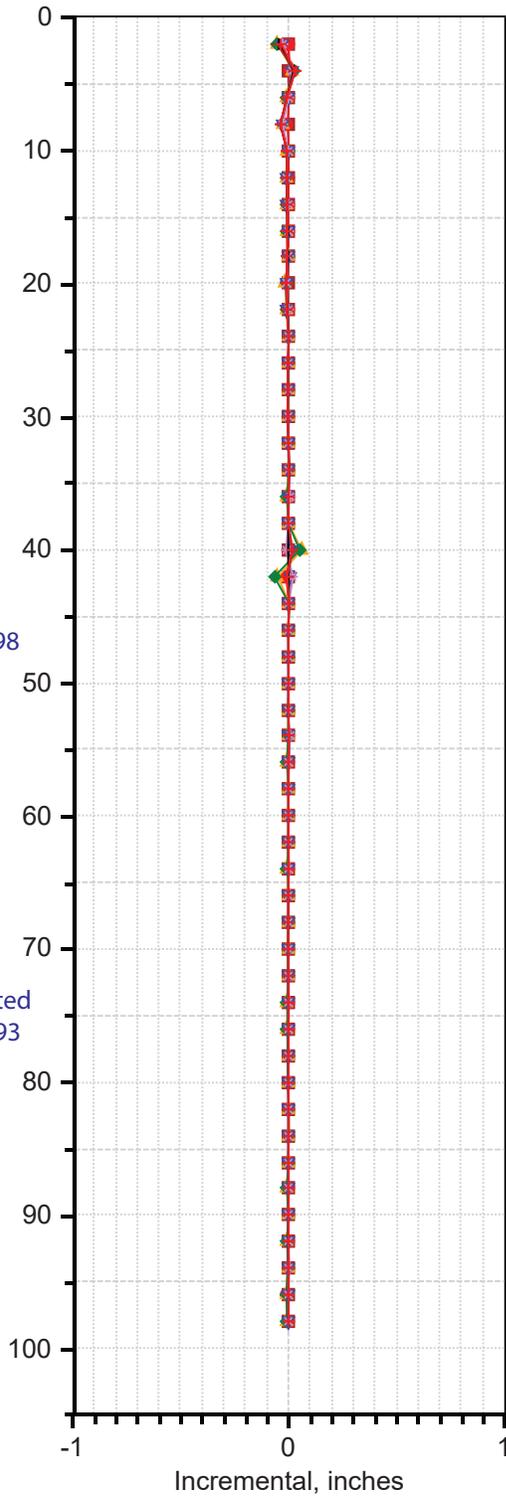
SI-5

Plot Type: Cumulative and Incremental		Plot Direction: B-Direction	
Depth of Survey (ft): 96		Baseline Date: 8/4/21	
Install Date: <7/1992		Interpreted Movement Since Baseline (in): 0.2	
Installed Depth (ft): 100		Interpreted Movement Monitoring Year (in): 0.19	

A-
208°



A+
28°



- 5/4/2021
- 5/18/2022
- ▲ 6/7/2023
- ◆ 7/27/2023
- ▼ 10/13/2023
- ✦ 11/14/2023
- ⊕ 2/8/2024
- ⊖ 3/28/2024
- ⊗ 8/23/2024

- 5/4/2021
- 5/18/2022
- ▲ 6/7/2023
- ◆ 7/27/2023
- ▼ 10/13/2023
- ✦ 11/14/2023
- ⊕ 2/8/2024
- ⊖ 3/28/2024
- ⊗ 8/23/2024

Plot of Slope Inclinometer

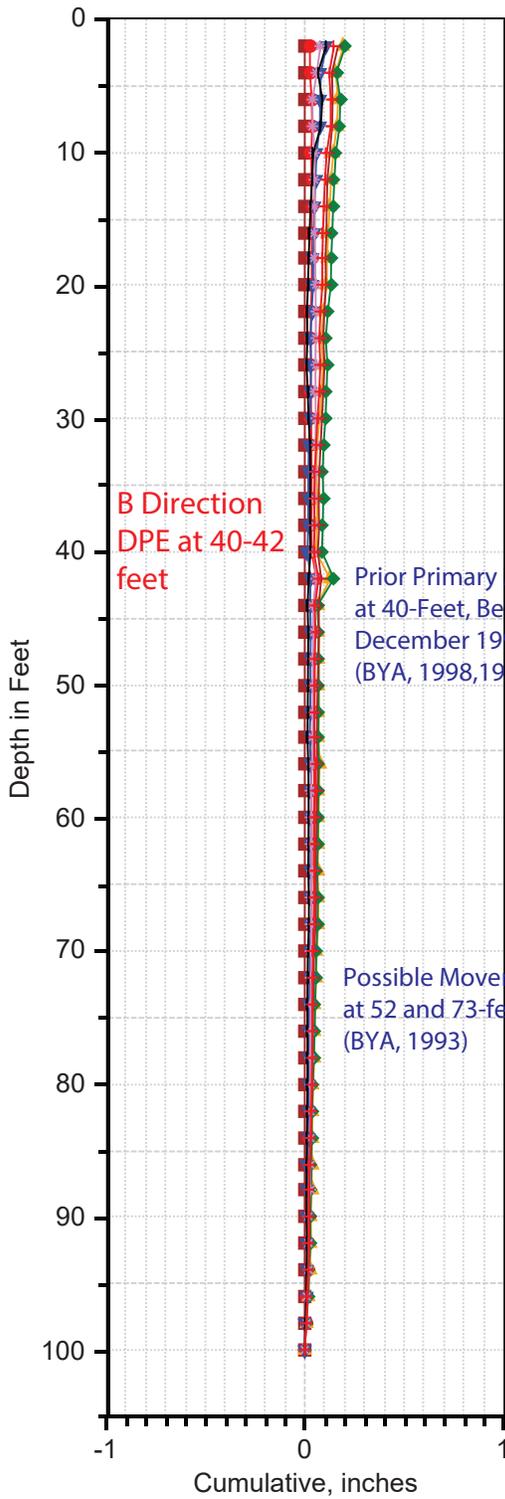
SI-7

Plot Type: Cumulative and Incremental		Plot Direction: A-Direction
Depth of Survey (ft): 102	Baseline Date: 5/4/21	Corrections: Rotation
Install Date: <7/1992	Installed Depth (ft): 100	Interpreted Movement Since Baseline (in): 0
		Interpreted Movement Monitoring Year (in): 0

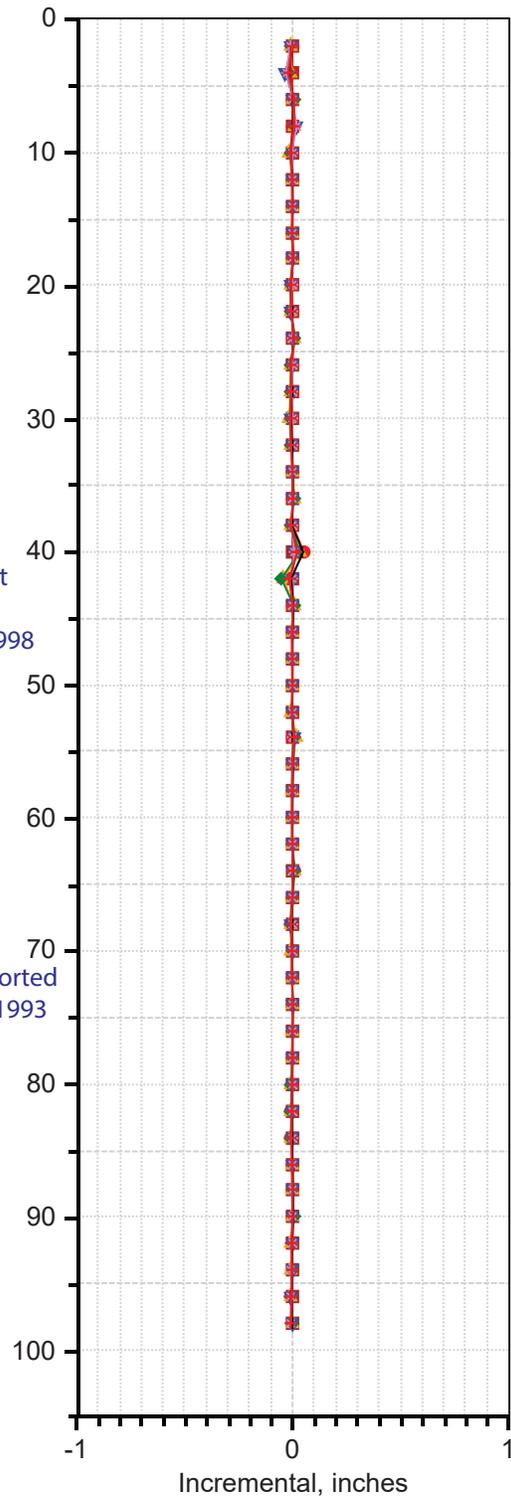


PROJECT:	Calle del Barco LAD Malibu, CA	PROJECT NUMBER: 220-277
REVISION DATE:	3/12/2025	

B-
298°



B+
118°



- | | | |
|-------------|--------------|--------------|
| ■ 5/4/2021 | ● 5/18/2022 | ▲ 6/7/2023 |
| ◆ 7/27/2023 | ▼ 10/13/2023 | ✦ 11/14/2023 |
| ⊕ 2/8/2024 | ⊖ 3/28/2024 | ⊗ 8/23/2024 |

- | | | |
|-------------|--------------|--------------|
| ■ 5/4/2021 | ● 5/18/2022 | ▲ 6/7/2023 |
| ◆ 7/27/2023 | ▼ 10/13/2023 | ✦ 11/14/2023 |
| ⊕ 2/8/2024 | ⊖ 3/28/2024 | ⊗ 8/23/2024 |

Plot of Slope Inclinometer

SI-7

Plot Type: Cumulative and Incremental		Plot Direction: B-Direction
Depth of Survey (ft): 102	Baseline Date: 5/4/21	Corrections: None
Install Date: <7/1992	Installed Depth (ft): 100	Interpreted Movement Since Baseline (in): 0
		Interpreted Movement Monitoring Year (in): 0



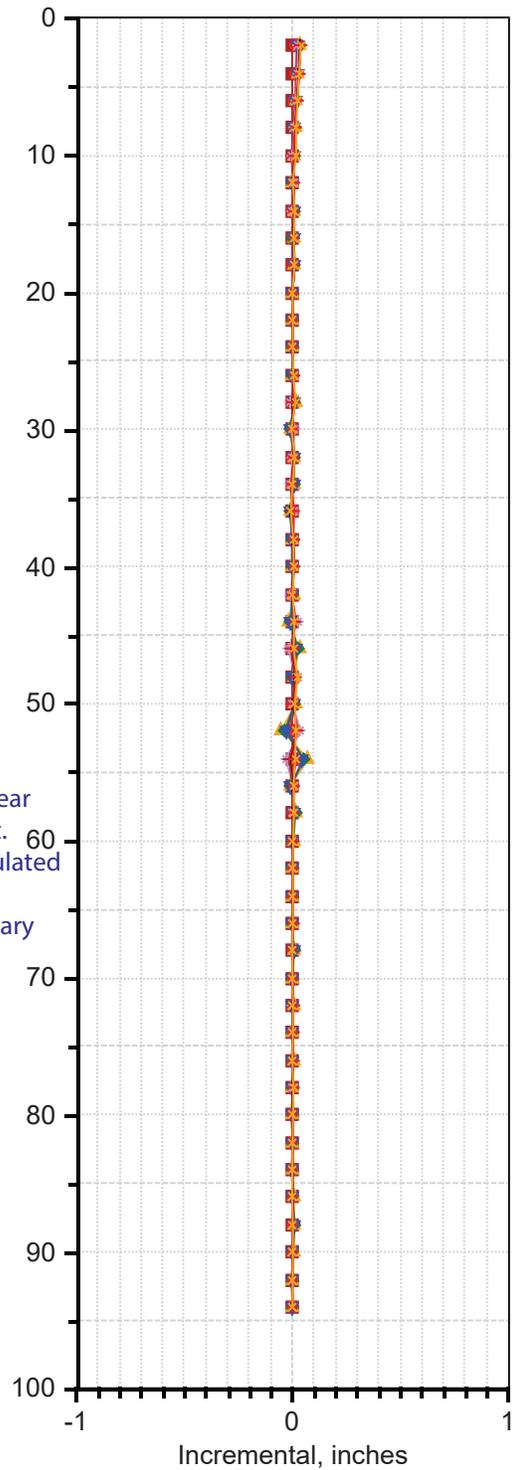
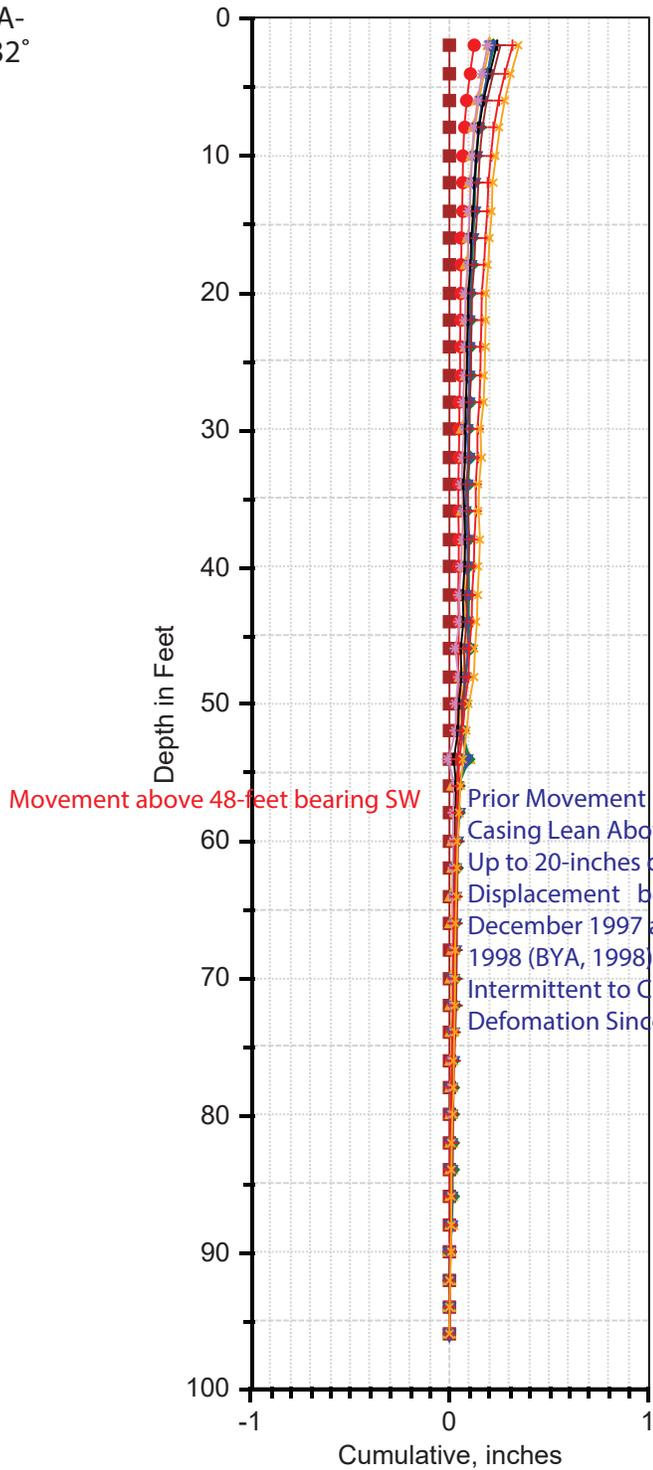
PROJECT: Calle del Barco LAD
Malibu, CA

PROJECT NUMBER:
220-277

REVISION DATE: 3/12/2025

A-
32°

A+
212°



Movement above 48-feet bearing SW
 Prior Movement is Non-Shear
 Casing Lean Above 60-feet.
 Up to 20-inches of Accumulated
 Displacement between
 December 1997 and February
 1998 (BYA, 1998).
 Intermittent to Creeping
 Defomation Since 1998

- 8/4/2021
- 5/18/2022
- ▲ 6/7/2023
- ◆ 7/27/2023
- ▼ 8/23/2023
- ◆ 11/14/2023
- + 2/8/2024
- 2/13/2024
- 3/28/2024
- 5/2/2024

- 8/4/2021
- 5/18/2022
- ▲ 6/7/2023
- ◆ 7/27/2023
- ▼ 8/23/2023
- ◆ 11/14/2023
- + 2/8/2024
- 2/13/2024
- 3/28/2024
- 5/2/2024

Plot of Slope Inclinometer

SI-9

Plot Type: Cumulative and Incremental

Plot Direction: A-Direction

Depth of Survey (ft): 96

Baseline Date: 8/4/21

Corrections: Rotation

Install Date: <12/1997

Installed Depth (ft): 100

Interpreted Movement Since Baseline (in): 0.3

Interpreted Movement Monitoring Year (in): 0.1



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PROJECT:

Calle del Barco LAD
 Malibu, CA

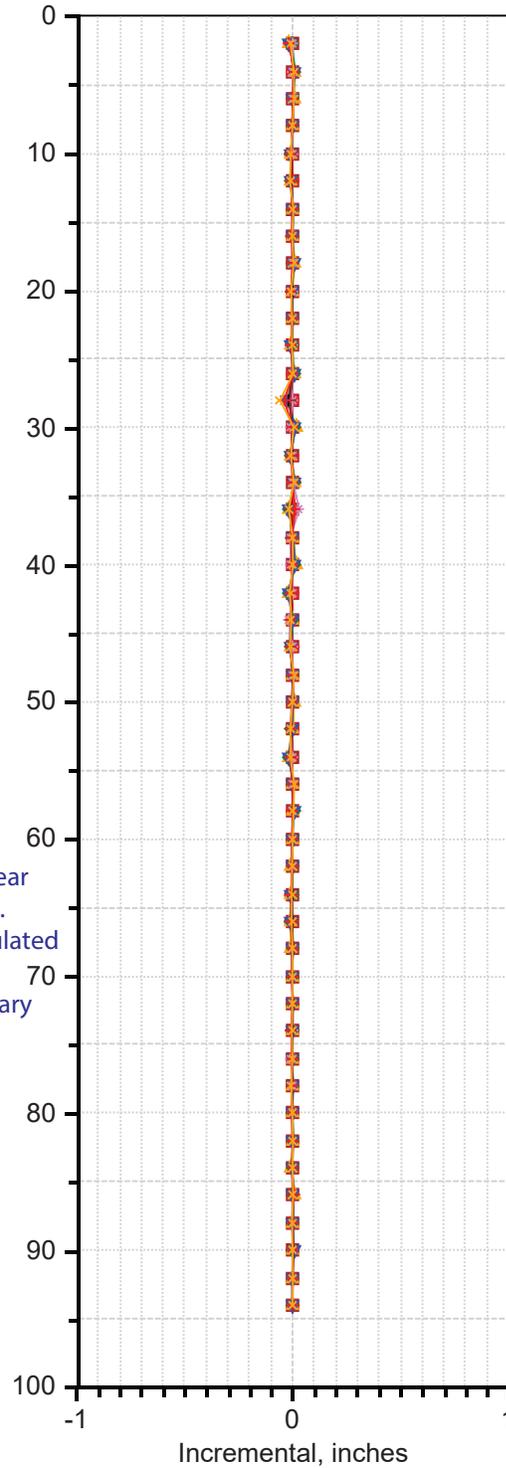
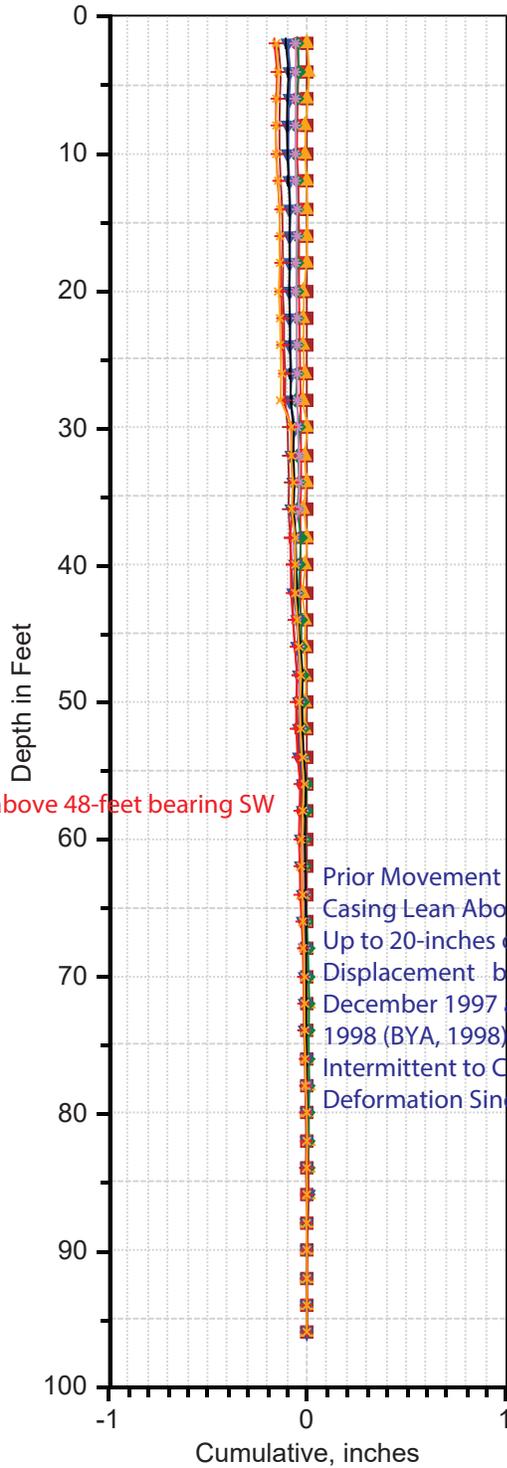
PROJECT NUMBER:

220-277

REVISION DATE: 3/13/2025

B-
122°

B+
302°



Movement above 48-feet bearing SW

Prior Movement is Non-Shear
Casing Lean Above 60-feet.
Up to 20-inches of Accumulated
Displacement between
December 1997 and February
1998 (BYA, 1998).
Intermittent to Creeping
Deformation Since 1998

- 8/4/2021
- 5/18/2022
- ▲ 6/7/2023
- ◆ 7/27/2023
- ▼ 8/23/2023
- ✦ 11/14/2023
- ⊕ 2/8/2024
- ⊖ 2/13/2024
- ⊗ 3/28/2024
- ⊙ 5/2/2024

- 8/4/2021
- 5/18/2022
- ▲ 6/7/2023
- ◆ 7/27/2023
- ▼ 8/23/2023
- ✦ 11/14/2023
- ⊕ 2/8/2024
- ⊖ 2/13/2024
- ⊗ 3/28/2024
- ⊙ 5/2/2024

Plot of Slope Inclinometer

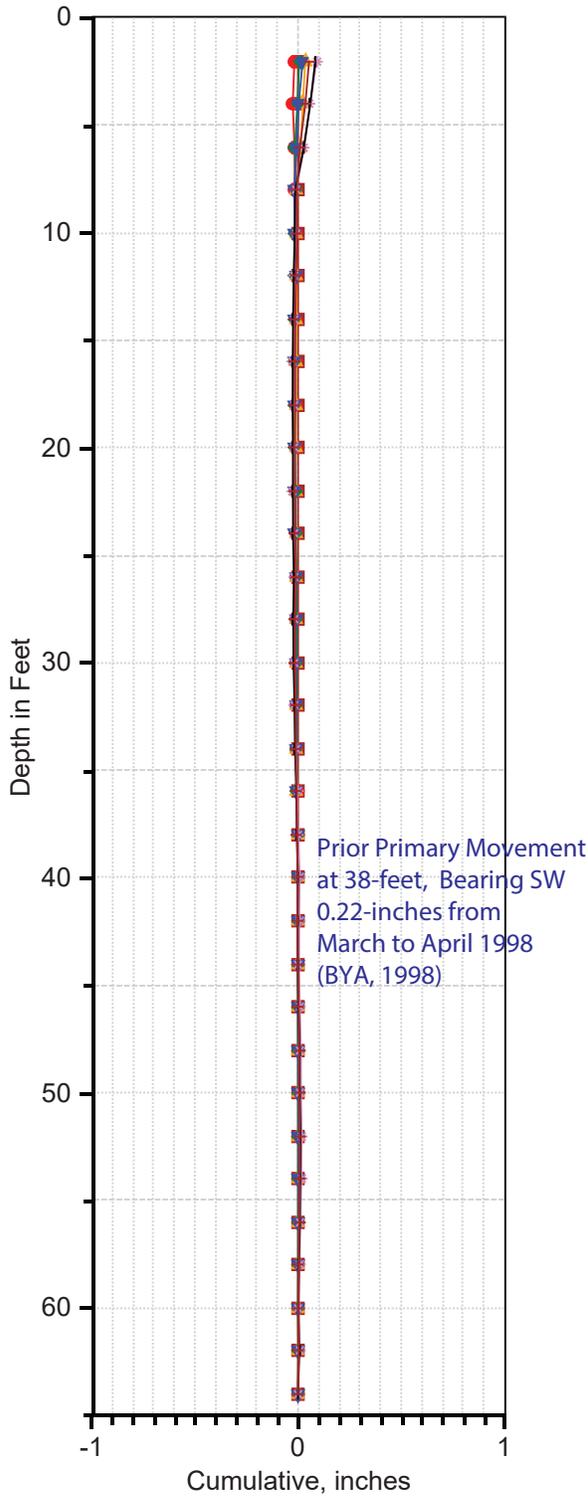
SI-9

Plot Type: Cumulative and Incremental		Plot Direction: B-Direction
Depth of Survey (ft): 96	Baseline Date: 8/4/21	Corrections: Rotation
Install Date: <12/1997	Installed Depth (ft): 100	Interpreted Movement Since Baseline (in): 0.3
		Interpreted Movement Monitoring Year (in): 0.1

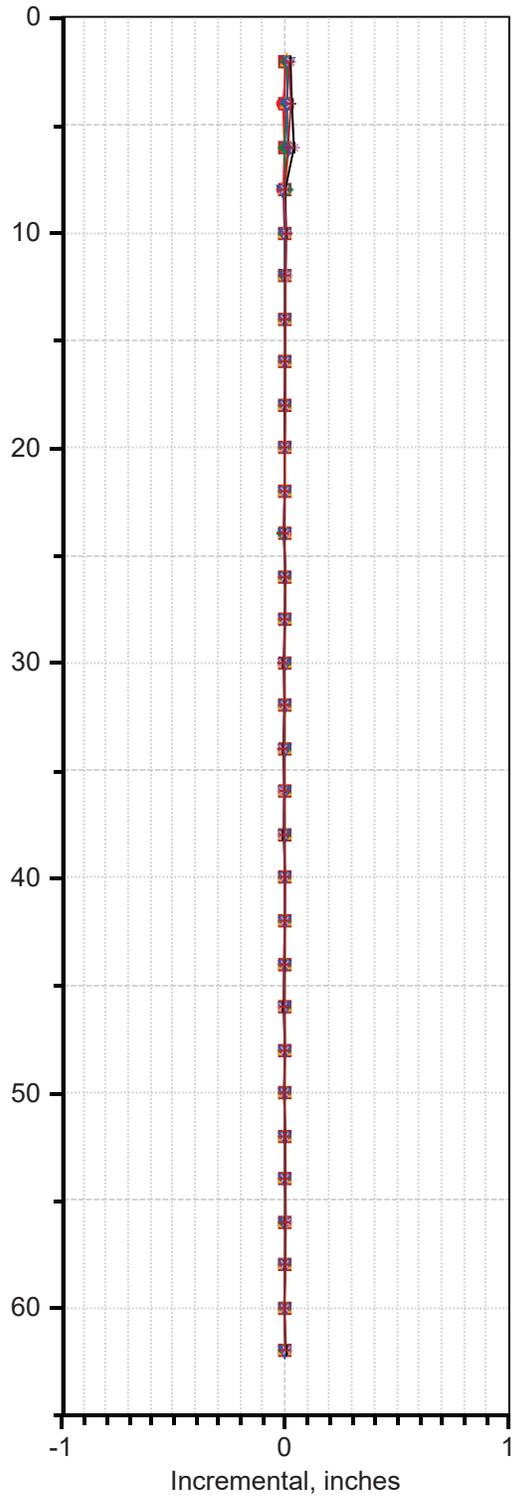


PROJECT: Calle del Barco LAD Malibu, CA	PROJECT NUMBER: 220-277
REVISION DATE: 3/13/2025	

A-
64°



A+
244°



- 8/4/2021
- 12/15/2021
- ▲ 5/18/2022
- ◆ 11/1/2022
- ▼ 1/19/2023
- ✦ 6/7/2023
- ⊕ 7/23/2023
- 8/23/2023

- 8/4/2021
- 12/15/2021
- ▲ 5/18/2022
- ◆ 11/1/2022
- ▼ 1/19/2023
- ✦ 6/7/2023
- ⊕ 7/23/2023
- 8/23/2023

Plot of Slope Inclinometer

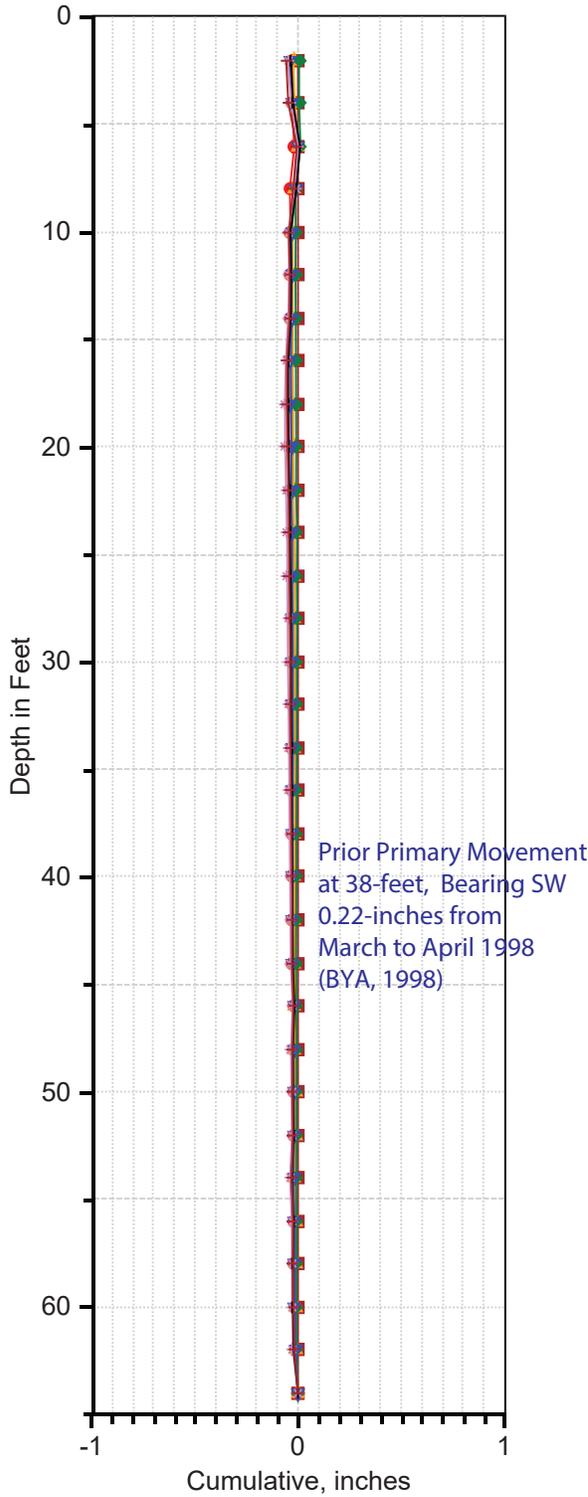
SI-10

Plot Type: Cumulative and Incremental		Plot Direction: A-Direction
Depth of Survey (ft): 62	Baseline Date: 8/4/20	Corrections: None
Install Date: 3/1998	Installed Depth (ft): 60	Interpreted Movement Since Baseline (in): 0
		Interpreted Movement Monitoring Year (in): 0

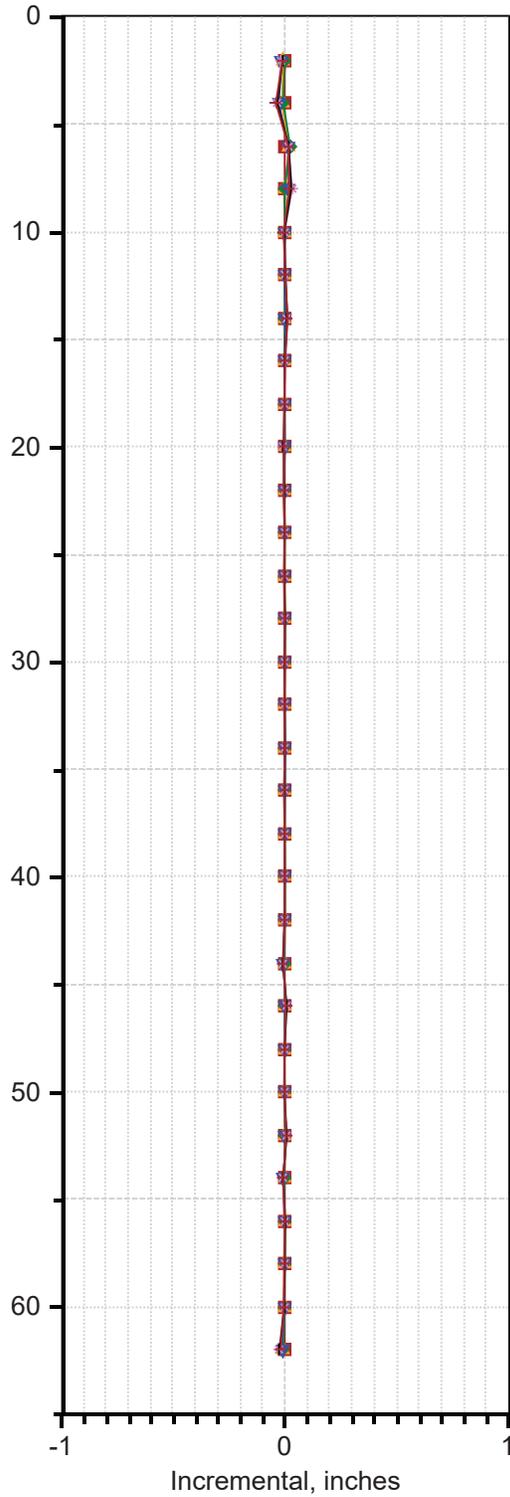


PROJECT: Calle del Barco LAD Malibu, CA	PROJECT NUMBER: 220-277
REVISION DATE: 3/12/2025	

B-
154°



B+
334°



- 8/4/2021
- 12/15/2021
- ▲ 5/18/2022
- ◆ 11/1/2022
- ▼ 1/19/2023
- ✦ 6/7/2023
- ⊕ 7/23/2023
- 8/23/2023

- 8/4/2021
- 12/15/2021
- ▲ 5/18/2022
- ◆ 11/1/2022
- ▼ 1/19/2023
- ✦ 6/7/2023
- ⊕ 7/23/2023
- 8/23/2023

Plot of Slope Inclinometer

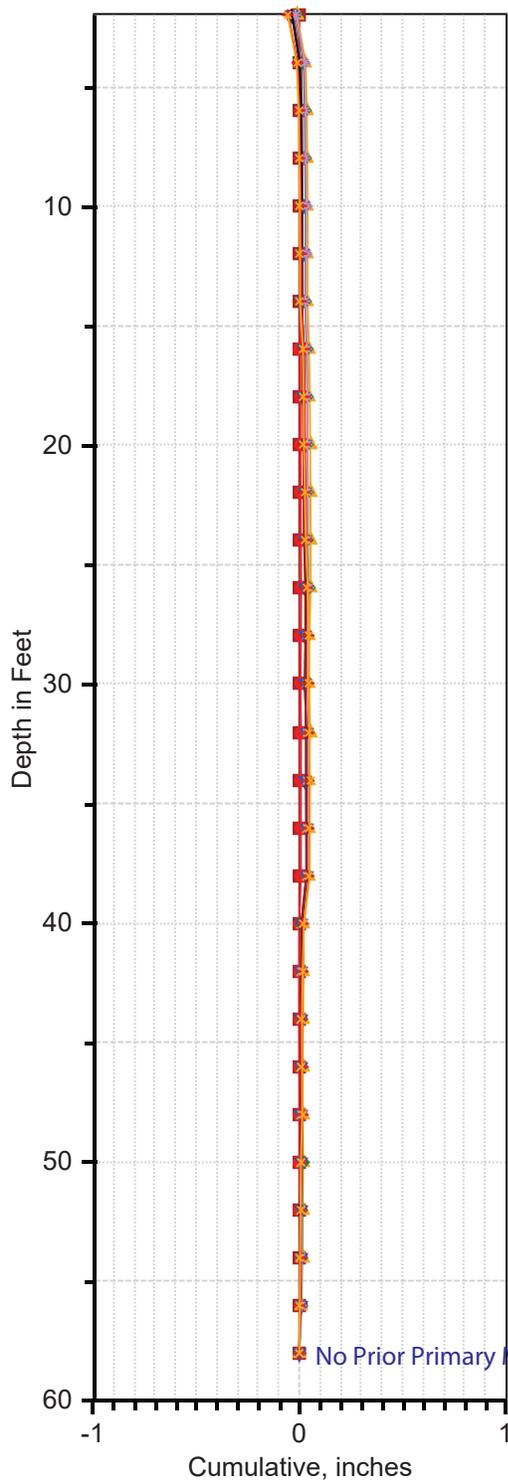
SI-10

Plot Type: Cumulative and Incremental		Plot Direction: B-Direction
Depth of Survey (ft): 62	Baseline Date: 8/4/21	Corrections: None
Install Date: 3/1998	Installed Depth (ft): 60	Interpreted Movement Since Baseline (in): 0
		Interpreted Movement Monitoring Year (in): 0

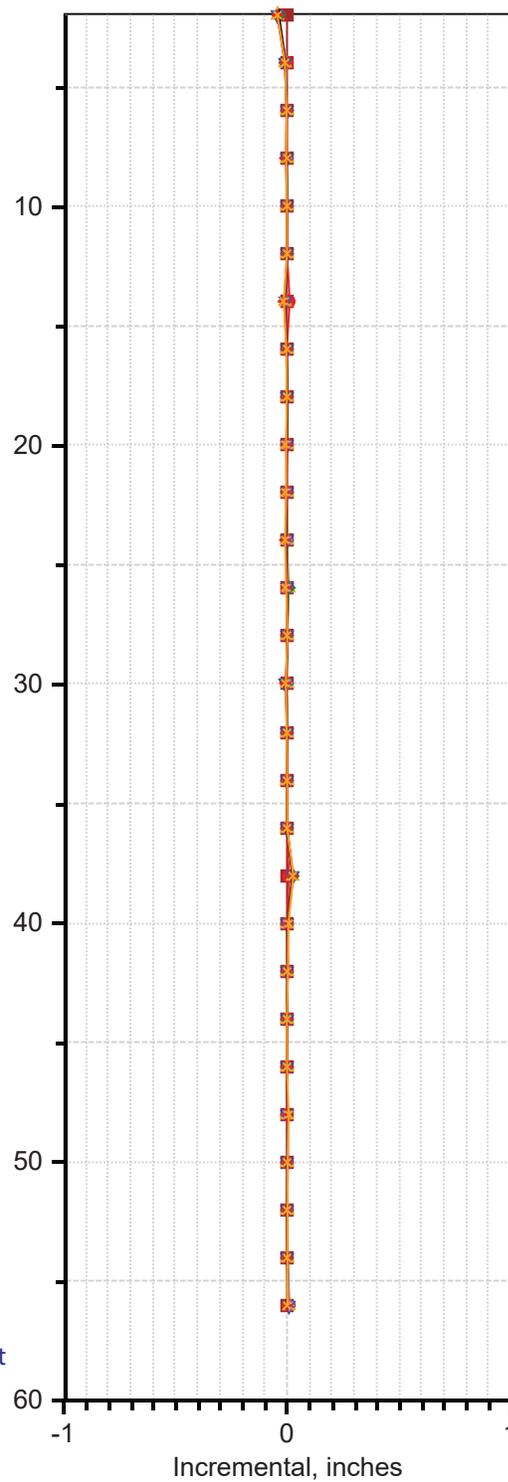


PROJECT: Calle del Barco LAD Malibu, CA	PROJECT NUMBER: 220-277
REVISION DATE: 3/12/2024	

A-78°



A+258°



- 8/4/2021
- 5/18/2022
- ▲ 6/9/2023
- ◆ 7/27/2023
- ▼ 9/14/2023
- ◆ 10/13/2023
- + 11/14/2023
- 2/8/2024
- + 3/28/2024
- 8/1/2024

- 8/4/2021
- 5/18/2022
- ▲ 6/9/2023
- ◆ 7/27/2023
- ▼ 9/14/2023
- ◆ 10/13/2023
- + 11/14/2023
- 2/8/2024
- + 3/28/2024
- 8/1/2024

Plot of Slope Inclinometer

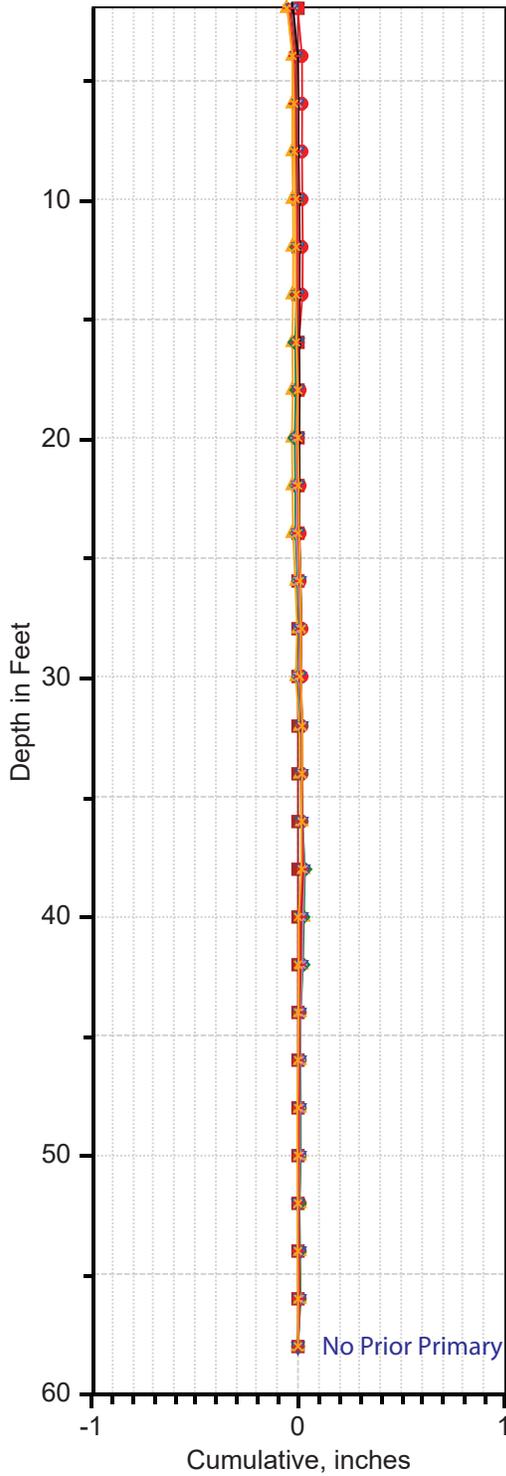
SI-11

Plot Type: Cumulative and Incremental		Plot Direction: A-Direction
Depth of Survey (ft): 57	Baseline Date: 8/4/21	Corrections: None
Install Date: 3/1998	Installed Depth (ft): 60	Interpreted Movement Since Baseline (in): 0
		Interpreted Movement Monitoring Year (in): 0



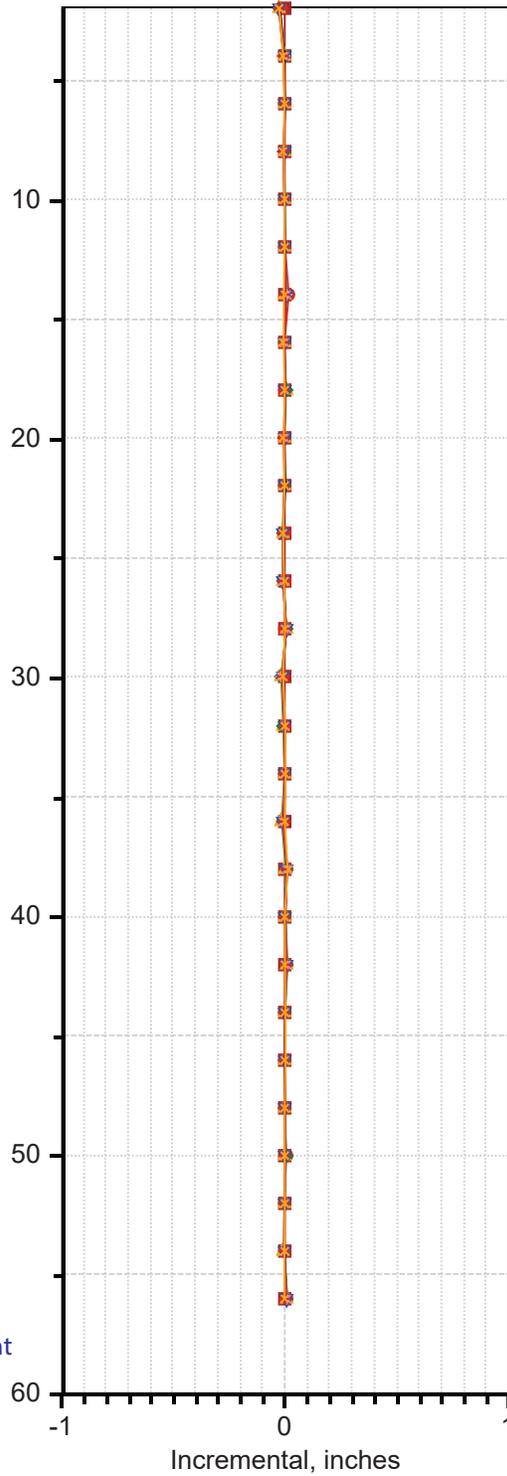
PROJECT: Calle del Barco LAD Malibu, CA	PROJECT NUMBER: 220-277
REVISION DATE: 3/12/2025	

B-
168°



No Prior Primary Movement

B+
348°



- 8/4/2021
- 5/18/2022
- ▲ 6/9/2023
- ◆ 7/27/2023
- ▼ 9/14/2023
- ◆ 10/13/2023
- + 11/14/2023
- 2/8/2024
- + 3/28/2024
- 8/1/2024

- 8/4/2021
- 5/18/2022
- ▲ 6/9/2023
- ◆ 7/27/2023
- ▼ 9/14/2023
- ◆ 10/13/2023
- + 11/14/2023
- 2/8/2024
- + 3/28/2024
- 8/1/2024

Plot of Slope Inclinometer

SI-11

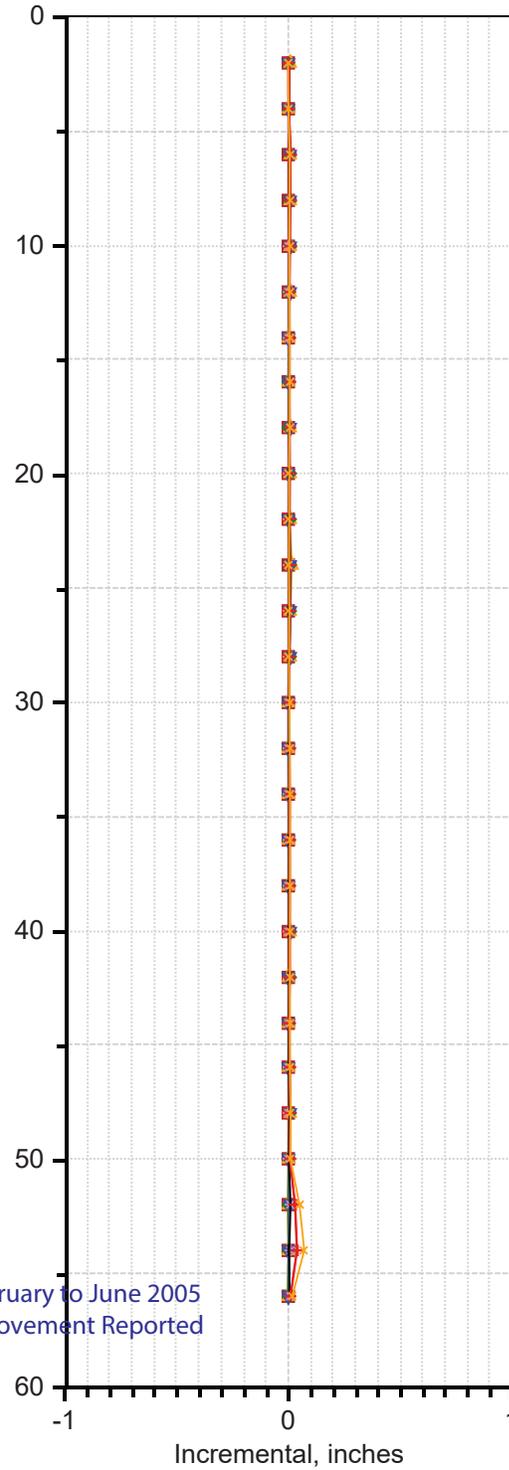
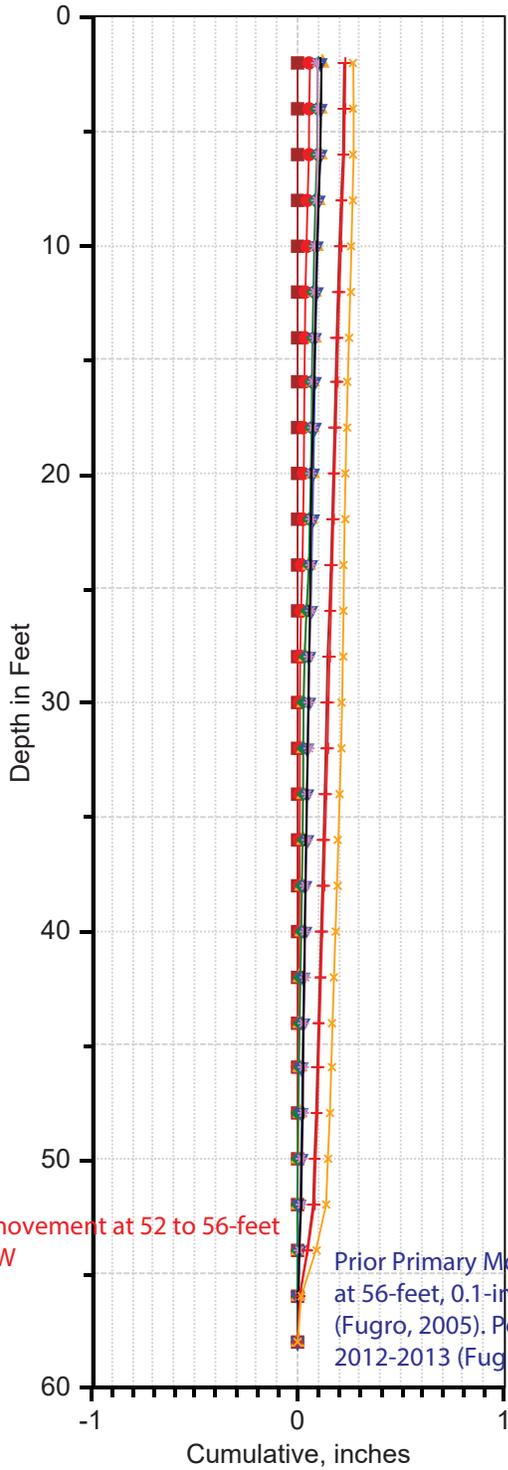
Plot Type: Cumulative and Incremental		Plot Direction: B-Direction
Depth of Survey (ft): 57	Baseline Date: 8/4/21	Corrections: None
Install Date: 3/1998	Installed Depth (ft): 60	Interpreted Movement Since Baseline (in): 0
		Interpreted Movement Monitoring Year (in): 0



PROJECT: Calle del Barco LAD Malibu, CA	PROJECT NUMBER: 220-277
REVISION DATE: 3/12/2025	

A-
58°

A+
238°



- 9/14/2021
- 5/18/2022
- ▲ 6/9/2023
- ◆ 7/27/2023
- ▼ 9/14/2023
- ✦ 11/14/2023
- + 2/8/2024
- 3/28/2024
- ✦ 4/9/2024
- ✦ 8/1/2024

- 9/14/2021
- 5/18/2022
- ▲ 6/9/2023
- ◆ 7/27/2023
- ▼ 9/14/2023
- ✦ 11/14/2023
- + 2/8/2024
- 3/28/2024
- ✦ 4/9/2024
- ✦ 8/1/2024

Plot of Slope Inclinometer

SI-12

Plot Type: Cumulative and Incremental

Plot Direction: A-Direction

Depth of Survey (ft): 56

Baseline Date: 9/14/2021

Corrections: None

Install Date: 3/1998

Installed Depth (ft): 60

Interpreted Movement Since Baseline (in): 0.14

Interpreted Movement Monitoring Year (in): 0.14



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PROJECT:

Calle del Barco LAD
Malibu, CA

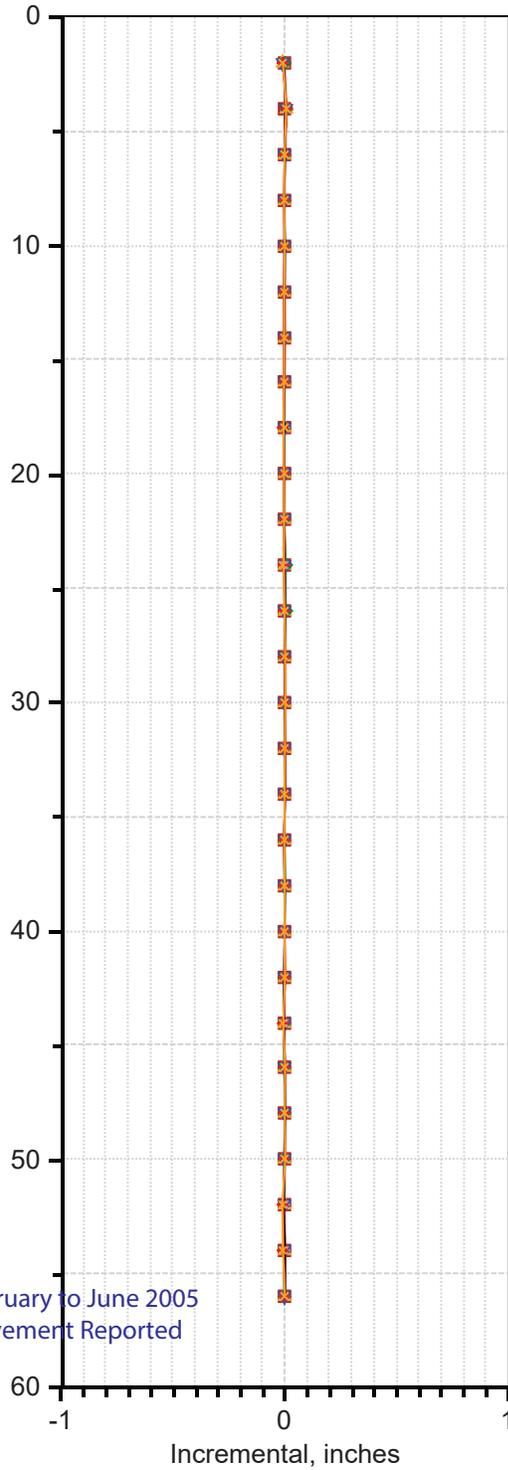
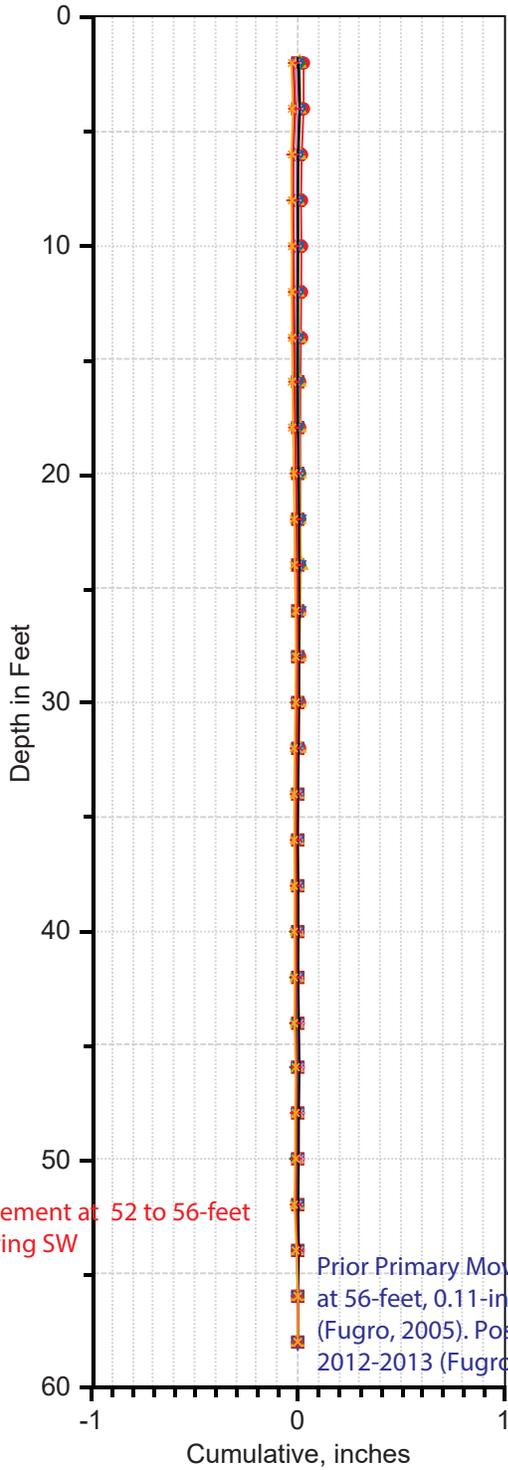
PROJECT NUMBER:

220-277

REVISION DATE: 3/12/2025

B-
148°

B+
328°



- 9/14/2021
- 5/18/2022
- ▲ 6/9/2023
- ◆ 7/27/2023
- ▼ 9/14/2023
- ✦ 11/14/2023
- ⊕ 2/8/2024
- ⊖ 3/28/2024
- ⊗ 4/9/2024
- ⊘ 8/1/2024

- 9/14/2021
- 5/18/2022
- ▲ 6/9/2023
- ◆ 7/27/2023
- ▼ 9/14/2023
- ✦ 11/14/2023
- ⊕ 2/8/2024
- ⊖ 3/28/2024
- ⊗ 4/9/2024
- ⊘ 8/1/2024

Plot of Slope Inclinometer

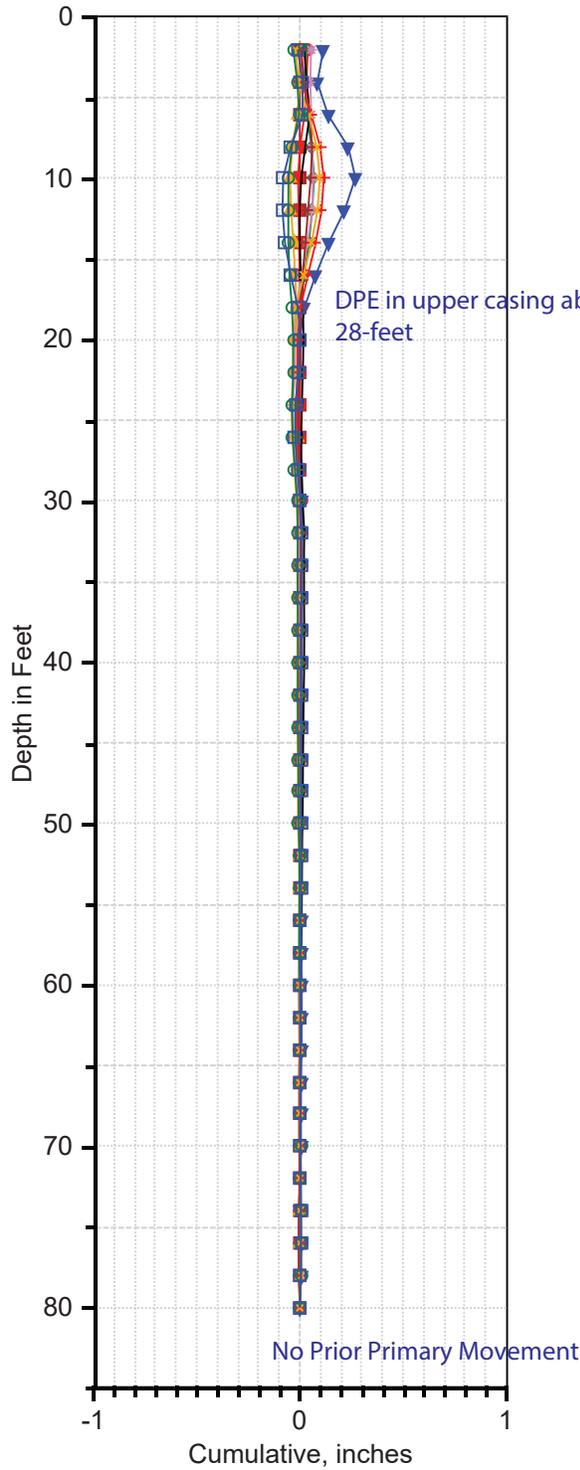
SI-12

Plot Type: Cumulative and Incremental		Plot Direction: B-Direction	
Depth of Survey (ft): 56		Baseline Date: 9/14/21	
Install Date: 3/1998		Corrections: None	
Installed Depth (ft): 60	Interpreted Movement Since Baseline (in): 0.14	Interpreted Movement Monitoring Year (in): 0.14	

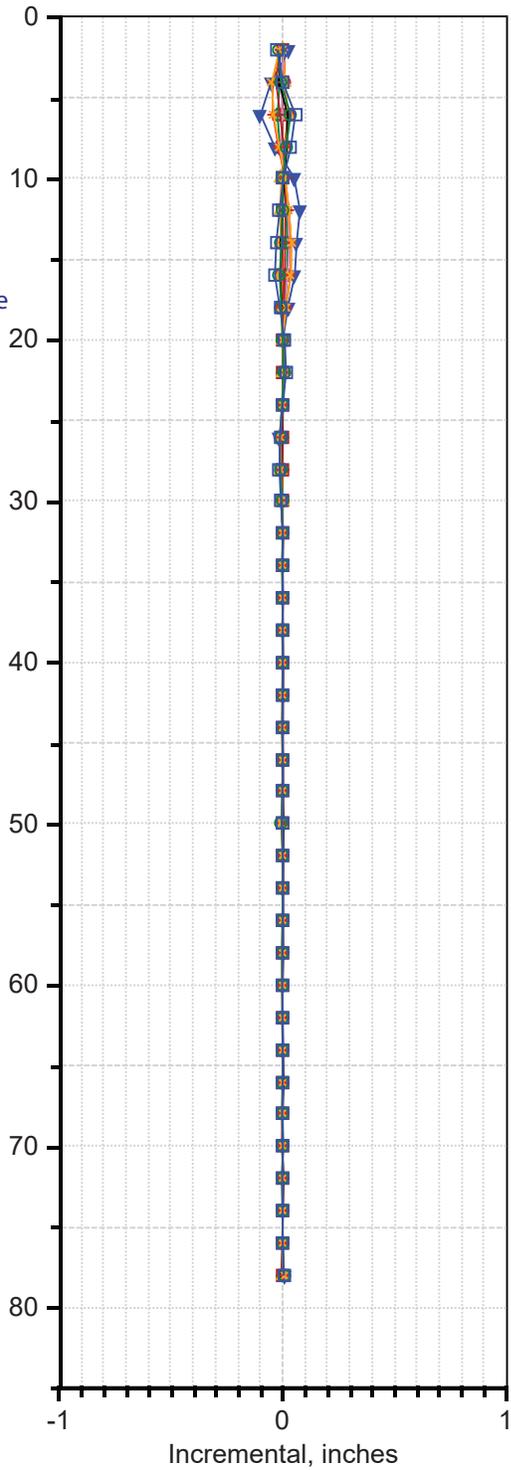


PROJECT:	Calle del Barco LAD Malibu, CA	PROJECT NUMBER:	220-277
REVISION DATE:	3/12/2025		

A-
30°



A+
210°



- 8/9/2021
- 12/15/2021
- ▲ 3/25/2022
- ◆ 5/18/2022
- ▼ 11/1/2022
- + 1/18/2023
- + 6/7/2023
- + 7/27/2023
- + 9/14/2023
- + 11/8/2023
- 2/8/2024
- 5/2/2024

- 8/9/2021
- 12/15/2021
- ▲ 3/25/2022
- ◆ 5/18/2022
- ▼ 11/1/2022
- + 1/18/2023
- + 6/7/2023
- + 7/27/2023
- + 9/14/2023
- + 11/8/2023
- 2/8/2024
- 5/2/2024

Plot of Slope Inclinometer

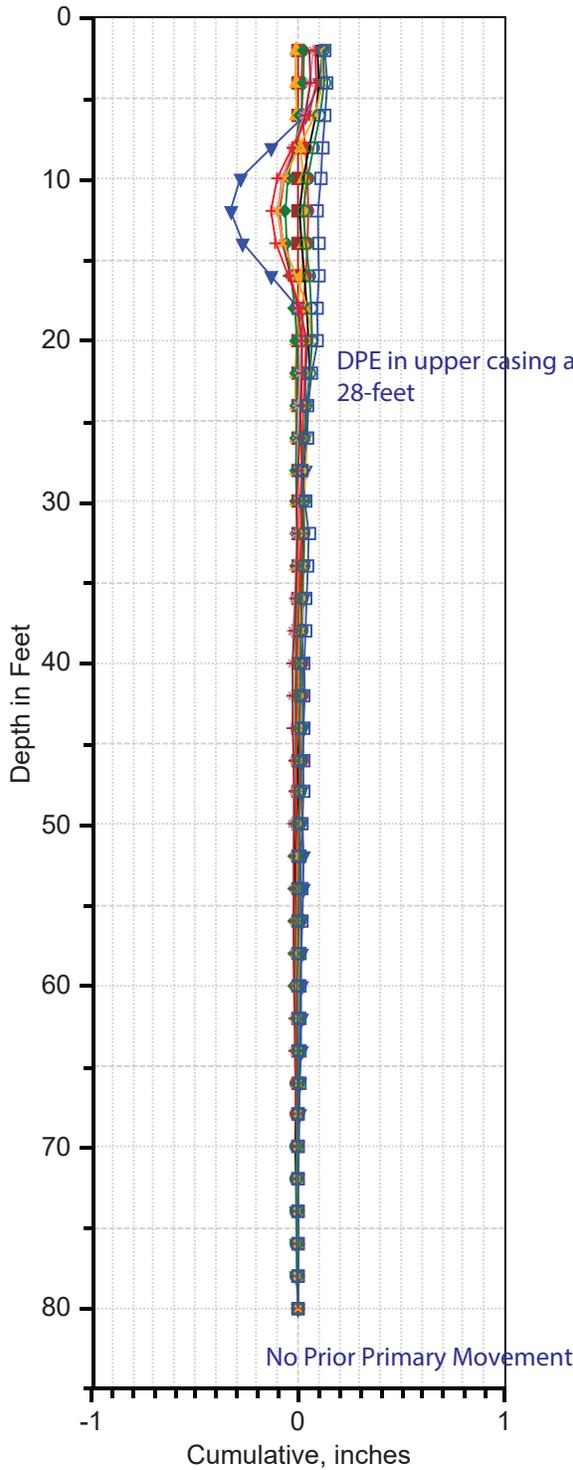
SI-13

Plot Type: Cumulative and Incremental		Plot Direction: A-Direction	
Depth of Survey (ft): 78		Baseline Date: 8/9/21	
Install Date: 9/1998		Corrections: None	
Installed Depth (ft): 80	Interpreted Movement Since Baseline (in): 0	Interpreted Movement Monitoring Year (in): 0	

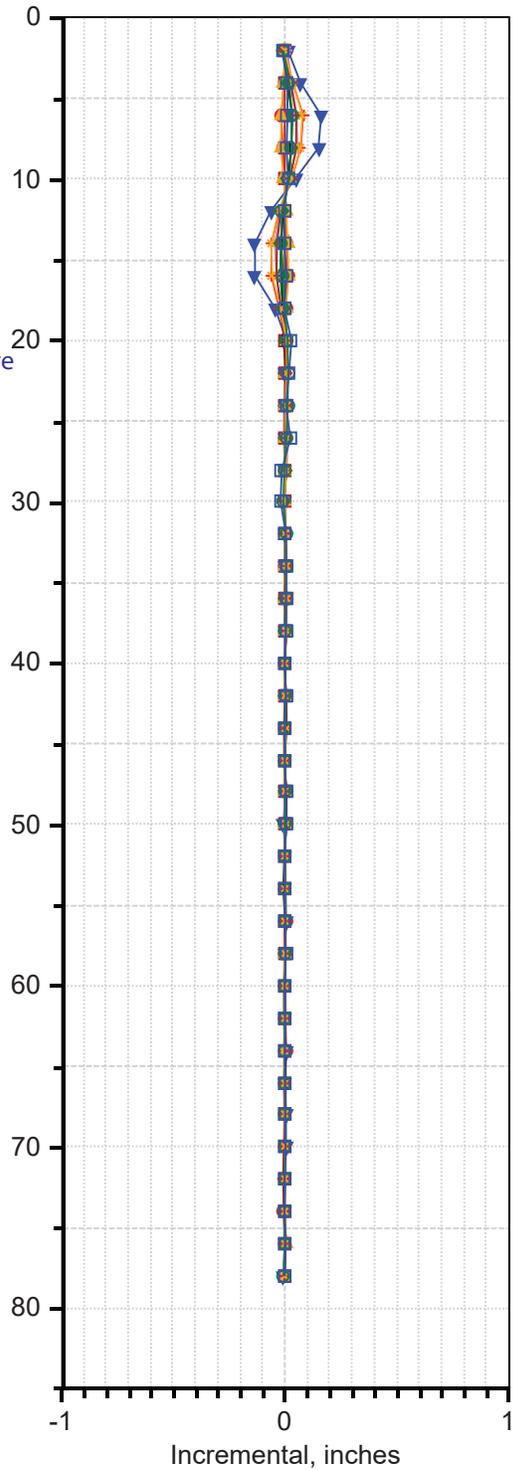


PROJECT: Calle del Barco LAD Malibu, CA	PROJECT NUMBER: 220-277
REVISION DATE: 3/12/2025	

B-
120°



B+
300°



- 8/9/2021
- 12/15/2021
- ▲ 3/25/2022
- 5/18/2022
- ▼ 11/1/2022
- ◆ 1/18/2023
- + 6/7/2023
- + 7/27/2023
- + 9/14/2023
- + 11/8/2023
- 2/8/2024
- 5/2/2024

- 8/9/2021
- 12/15/2021
- ▲ 3/25/2022
- 5/18/2022
- ▼ 11/1/2022
- ◆ 1/18/2023
- + 6/7/2023
- + 7/27/2023
- + 9/14/2023
- + 11/8/2023
- 2/8/2024
- 5/2/2024

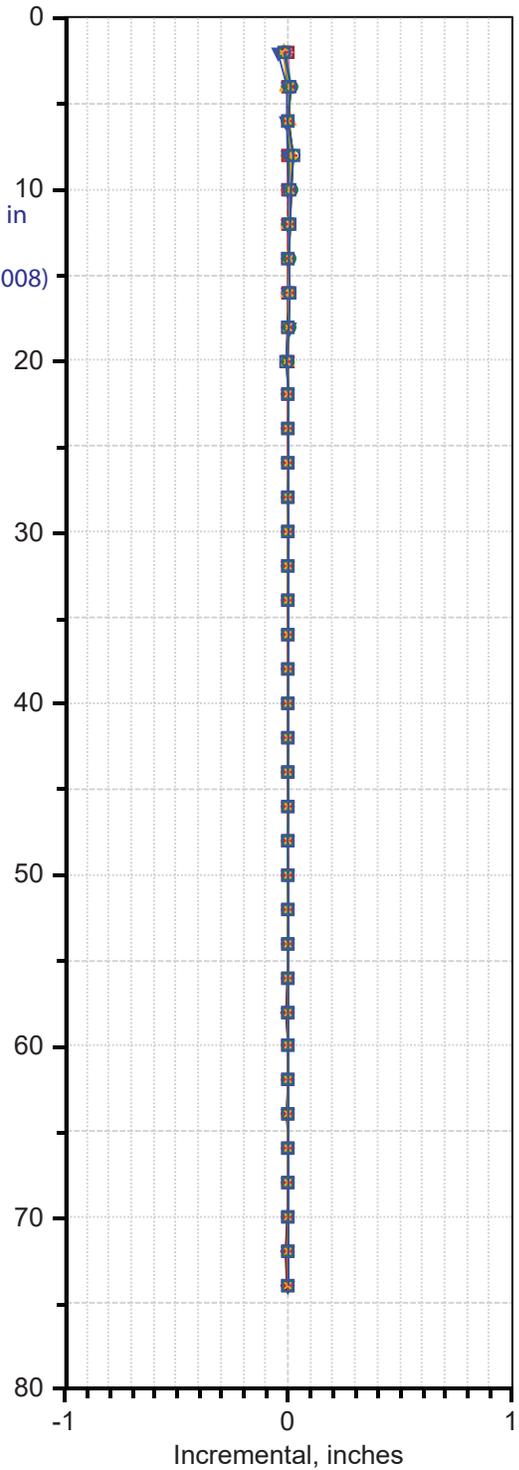
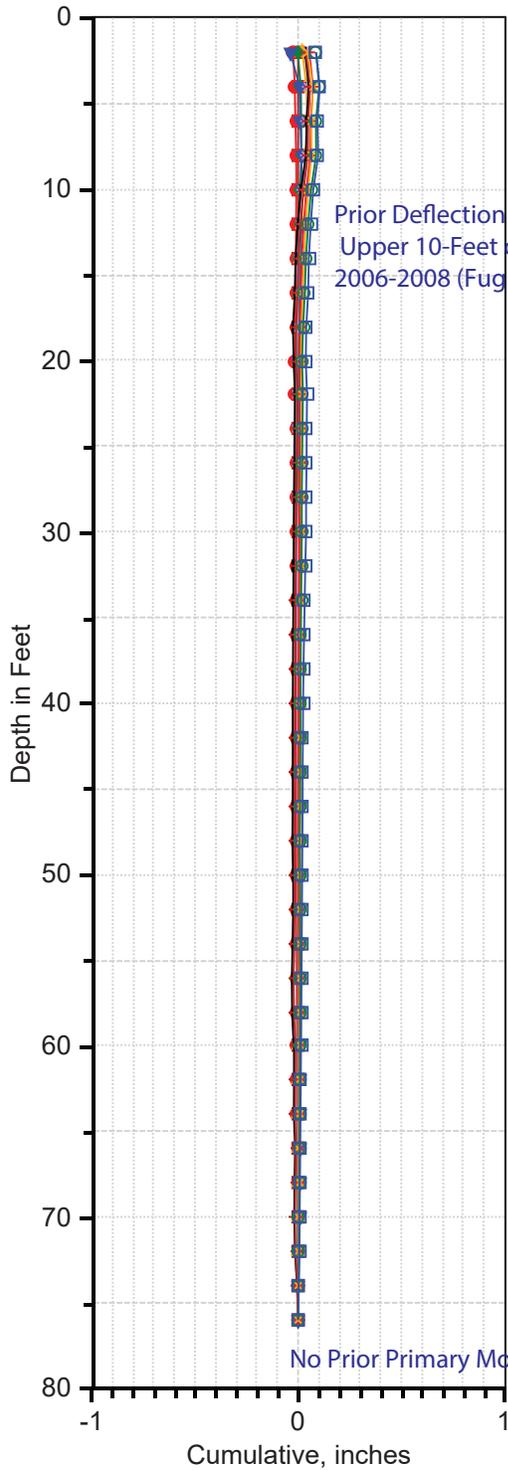
Plot of Slope Inclinometer

SI-13

Plot Type: Cumulative and Incremental		Plot Direction: B-Direction	
Depth of Survey (ft): 78		Baseline Date: 8/9/21	
Install Date: 9/1998		Corrections: None	
Installed Depth (ft): 80	Interpreted Movement Since Baseline (in): 0	Interpreted Movement Monitoring Year (in): 0	

A-
44°

A+
224°



- 8/9/2021
- 12/15/2021
- ▲ 3/25/2022
- ◆ 5/18/2022
- ▼ 11/1/2022
- ✦ 1/18/2023
- ⊕ 6/7/2023
- ⊖ 7/27/2023
- ⊗ 9/14/2023
- ⊘ 11/8/2023
- 2/8/2024
- 5/2/2024

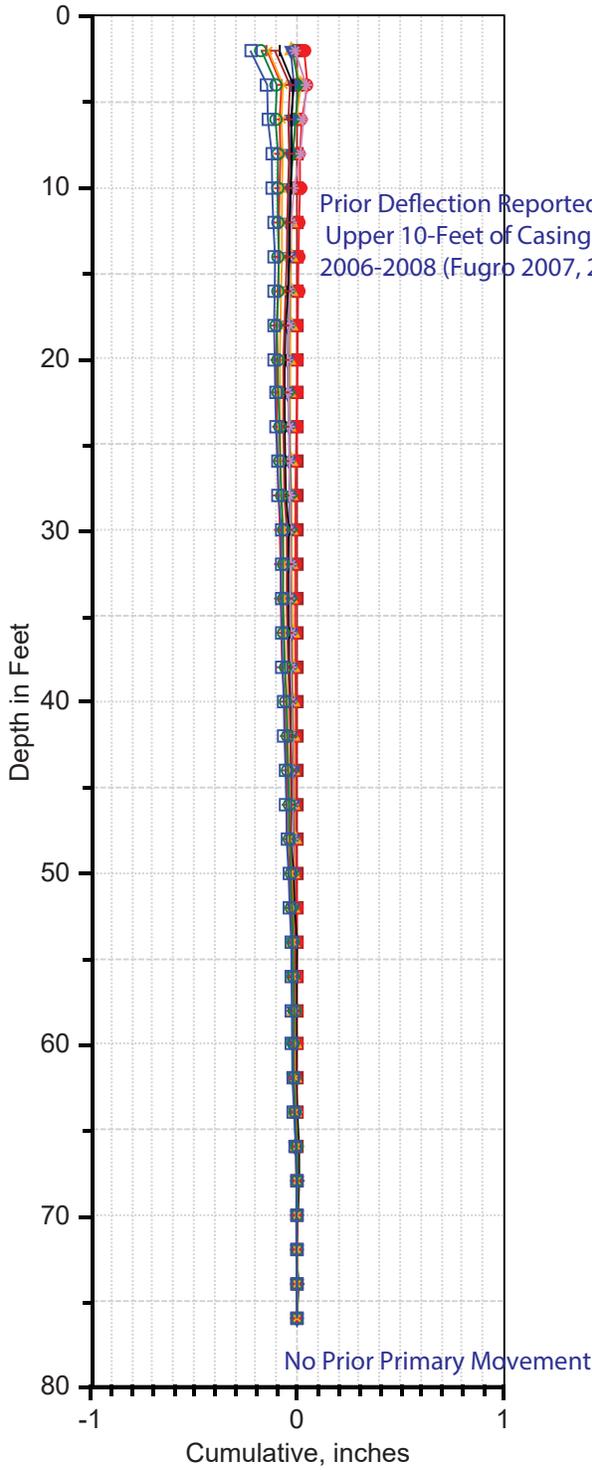
- 8/9/2021
- 12/15/2021
- ▲ 3/25/2022
- ◆ 5/18/2022
- ▼ 11/1/2022
- ✦ 1/18/2023
- ⊕ 6/7/2023
- ⊖ 7/27/2023
- ⊗ 9/14/2023
- ⊘ 11/8/2023
- 2/8/2024
- 5/2/2024

Plot of Slope Inclinometer <h1 style="margin: 0;">SI-14</h1>	Plot Type: Cumulative and Incremental		Plot Direction: A-Direction
	Depth of Survey (ft): 76	Baseline Date: 8/9/21	Corrections: None
	Install Date: 9/1998	Installed Depth (ft): 78	Interpreted Movement Since Baseline (in): 0
		Interpreted Movement Monitoring Year (in): 0	

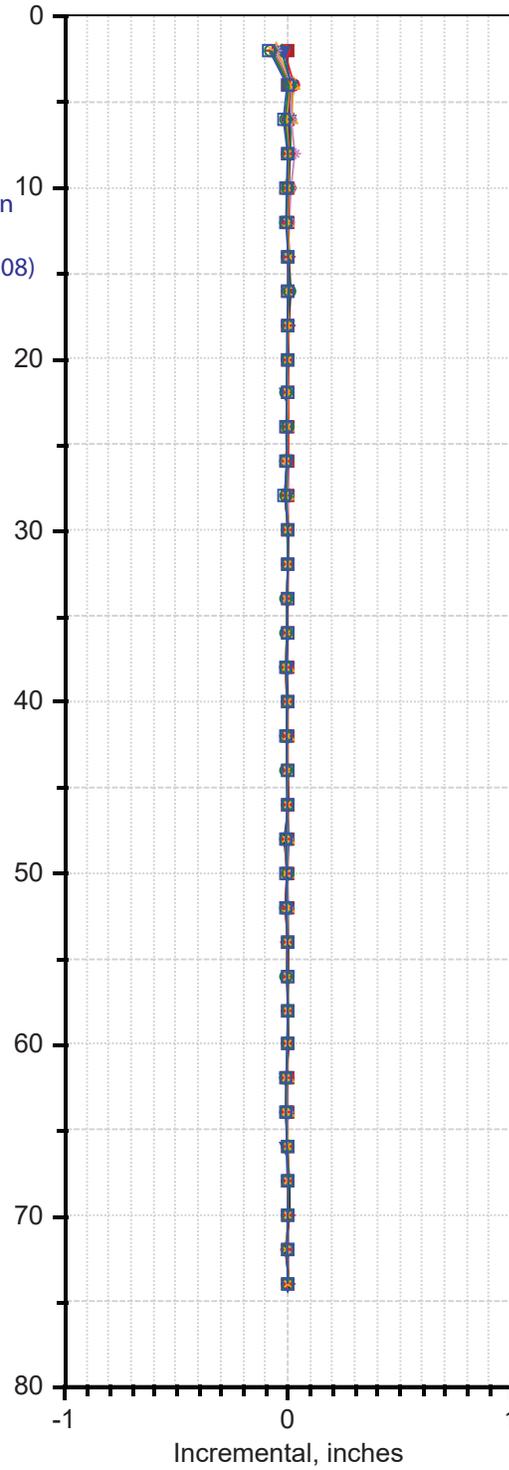
Yeh and Associates, Inc.
 Geotechnical • Geological • Construction Services

PROJECT: **Calle del Barco LAD** PROJECT NUMBER: **220-277**
 Malibu, CA
 REVISION DATE: 3/14/2025

B-
134°



B+
314°



- 8/9/2021
- 12/15/2021
- ▲ 3/25/2022
- 8/9/2021
- 12/15/2021
- ▲ 3/25/2022
- ◆ 5/18/2022
- ▼ 11/1/2022
- ✦ 1/18/2023
- ◆ 5/18/2022
- ▼ 11/1/2022
- ✦ 1/18/2023
- ✦ 6/7/2023
- 7/27/2023
- ✦ 9/14/2023
- ✦ 6/7/2023
- 7/27/2023
- ✦ 9/14/2023
- ▲ 11/8/2023
- 2/8/2024
- 5/2/2024
- ▲ 11/8/2023
- 2/8/2024
- 5/2/2024

Plot of Slope Inclinometer

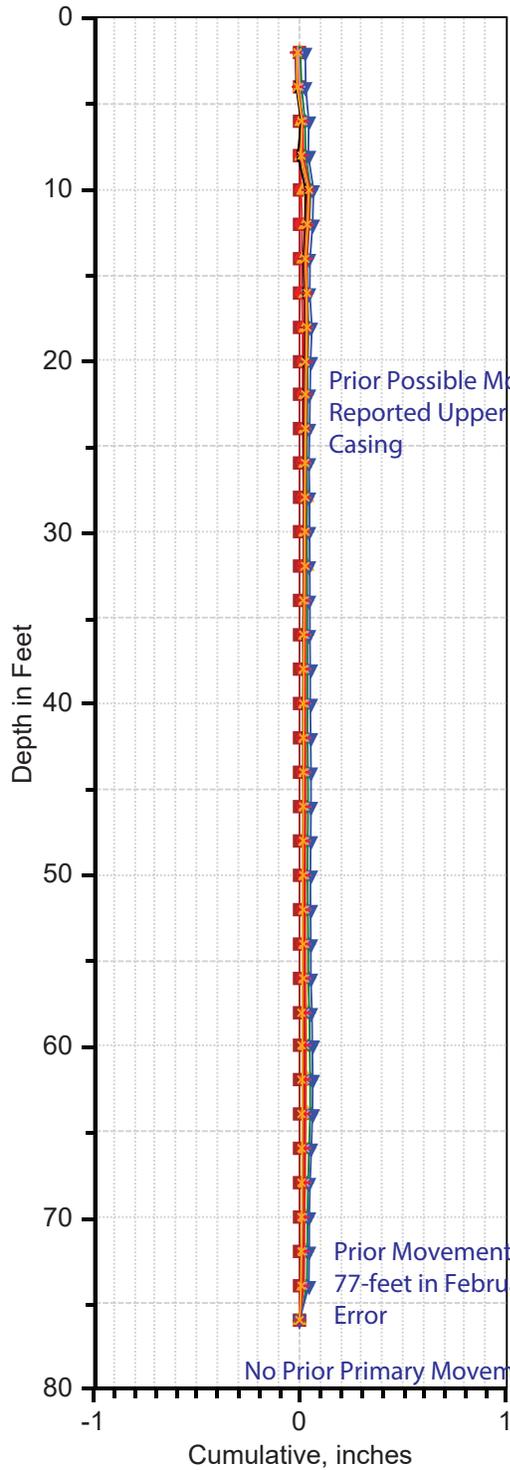
SI-14

Plot Type: Cumulative and Incremental		Plot Direction: B-Direction	
Depth of Survey (ft): 76		Baseline Date: 8/9/21	
Install Date: 9/1998		Corrections: None	
Installed Depth (ft): 78	Interpreted Movement Since Baseline (in): 0	Interpreted Movement Monitoring Year (in): 0	

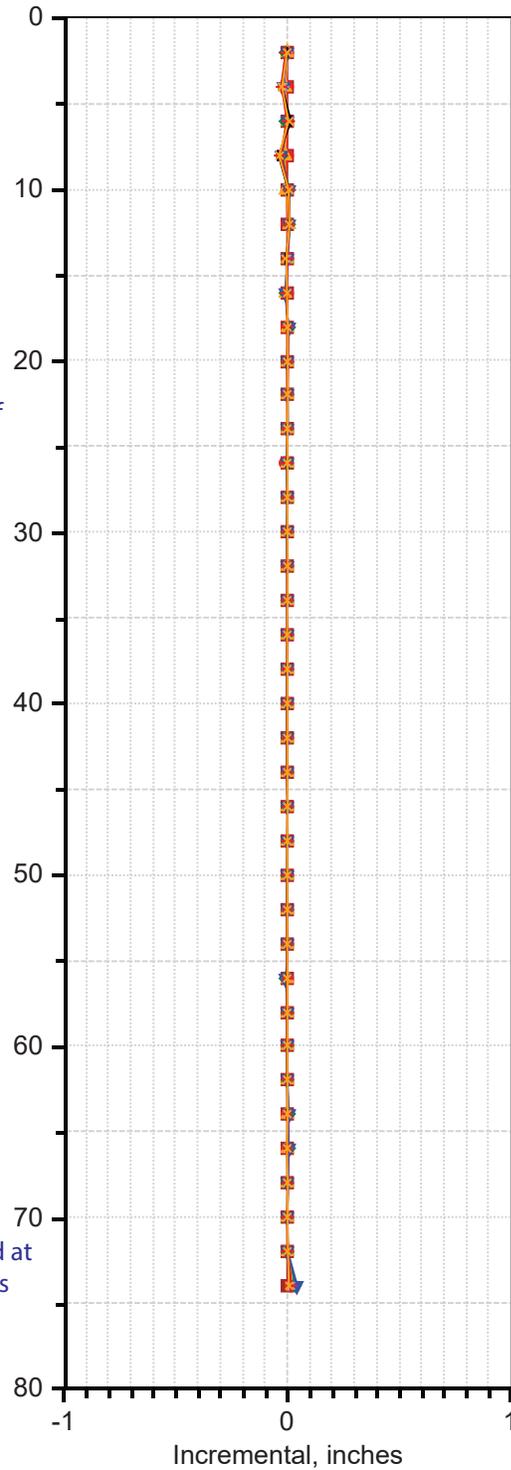


PROJECT: Calle del Barco LAD Malibu, CA	PROJECT NUMBER: 220-277
REVISION DATE: 3/14/2025	

A-
10°



A+
190°



- 5/3/2021
- 8/3/2021
- ▲ 5/18/2022
- ◆ 6/7/2023
- ▼ 7/27/2023
- ◆ 9/14/2023
- + 11/14/2023
- 2/8/2024
- + 3/28/2024
- 8/1/2024

- 5/3/2021
- 8/3/2021
- ▲ 5/18/2022
- ◆ 6/7/2023
- ▼ 7/27/2023
- ◆ 9/14/2023
- + 11/14/2023
- 2/8/2024
- + 3/28/2024
- 8/1/2024

Plot of Slope Inclinometer

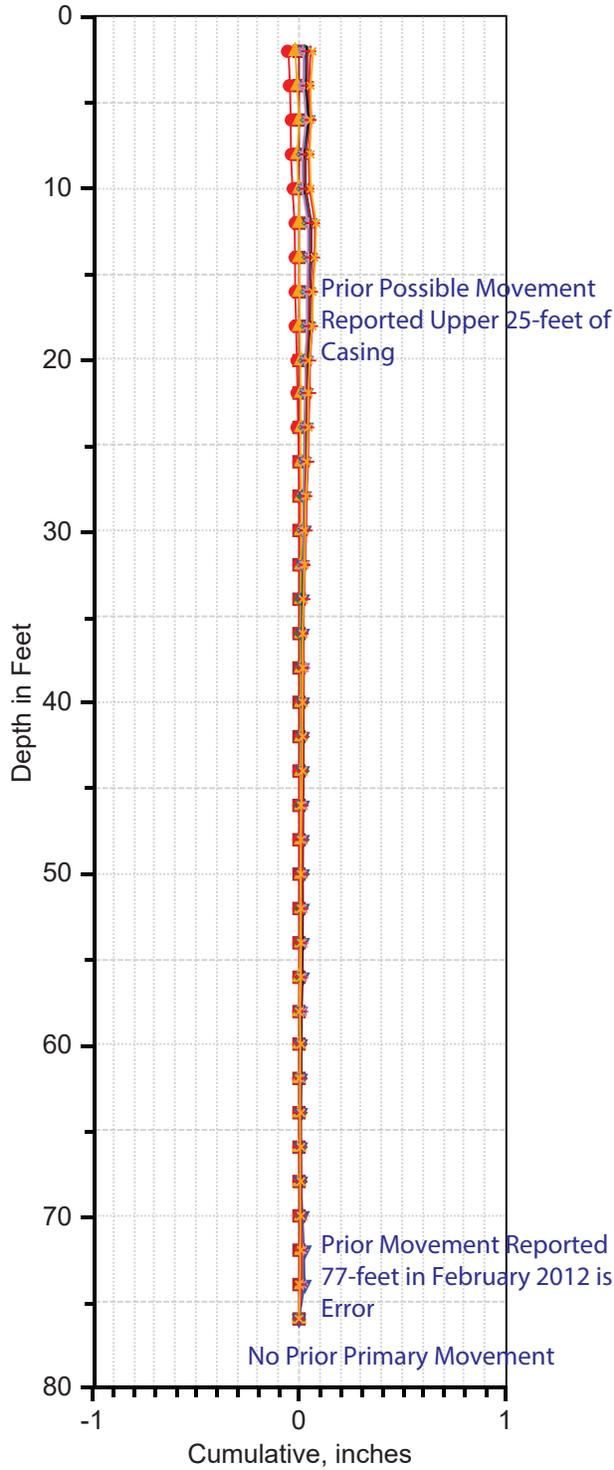
SI-15

Plot Type: Cumulative and Incremental		Plot Direction: A-Direction
Depth of Survey (ft): 74	Baseline Date: 5/3/21	Corrections: None
Install Date: 9/1998	Installed Depth (ft): 80	Interpreted Movement Since Baseline (in): 0
		Interpreted Movement Monitoring Year (in): 0

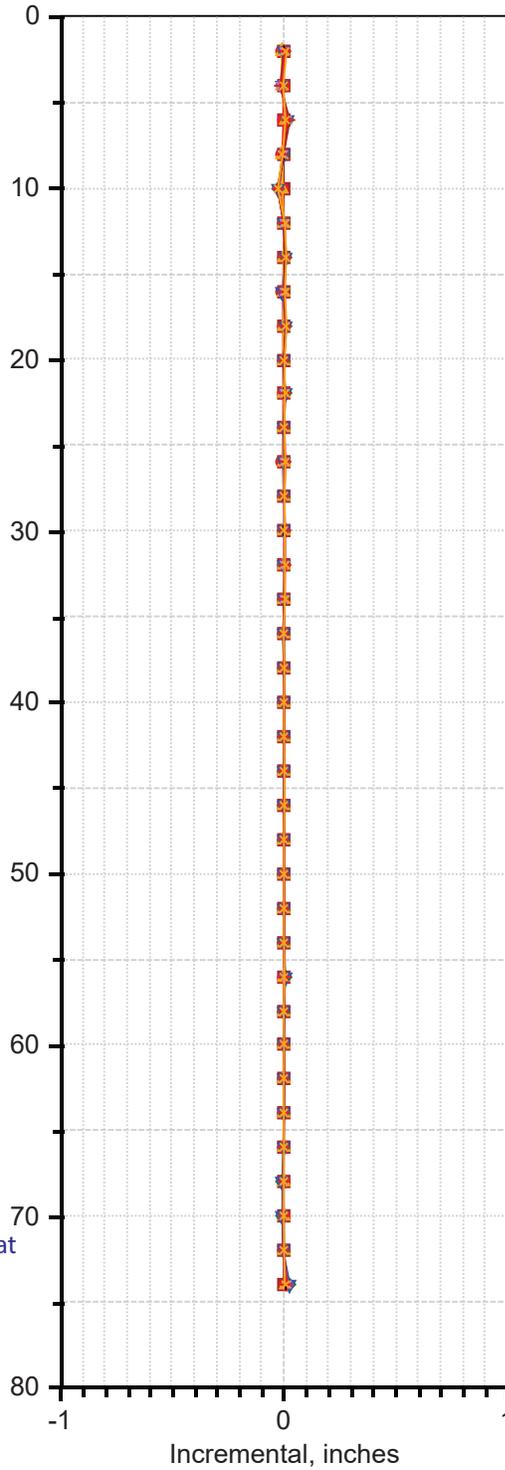


PROJECT: Calle del Barco LAD Malibu, CA	PROJECT NUMBER: 220-277
REVISION DATE: 3/12/2025	

B-
100°



B+
280°



- 5/3/2021
- 8/3/2021
- ▲ 5/18/2022
- ◆ 6/7/2023
- ▼ 7/27/2023
- + 9/14/2023
- + 11/14/2023
- 2/8/2024
- + 3/28/2024
- + 8/1/2024

- 5/3/2021
- 8/3/2021
- ▲ 5/18/2022
- ◆ 6/7/2023
- ▼ 7/27/2023
- + 9/14/2023
- + 11/14/2023
- 2/8/2024
- + 3/28/2024
- + 8/1/2024

Plot of Slope Inclinometer

SI-15

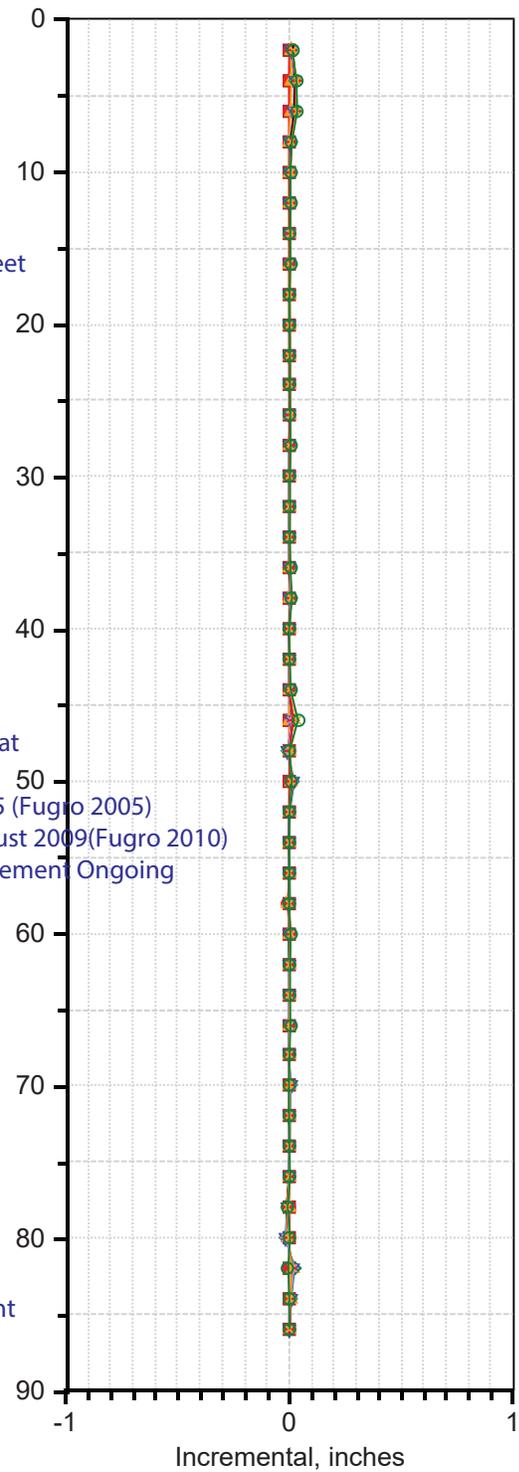
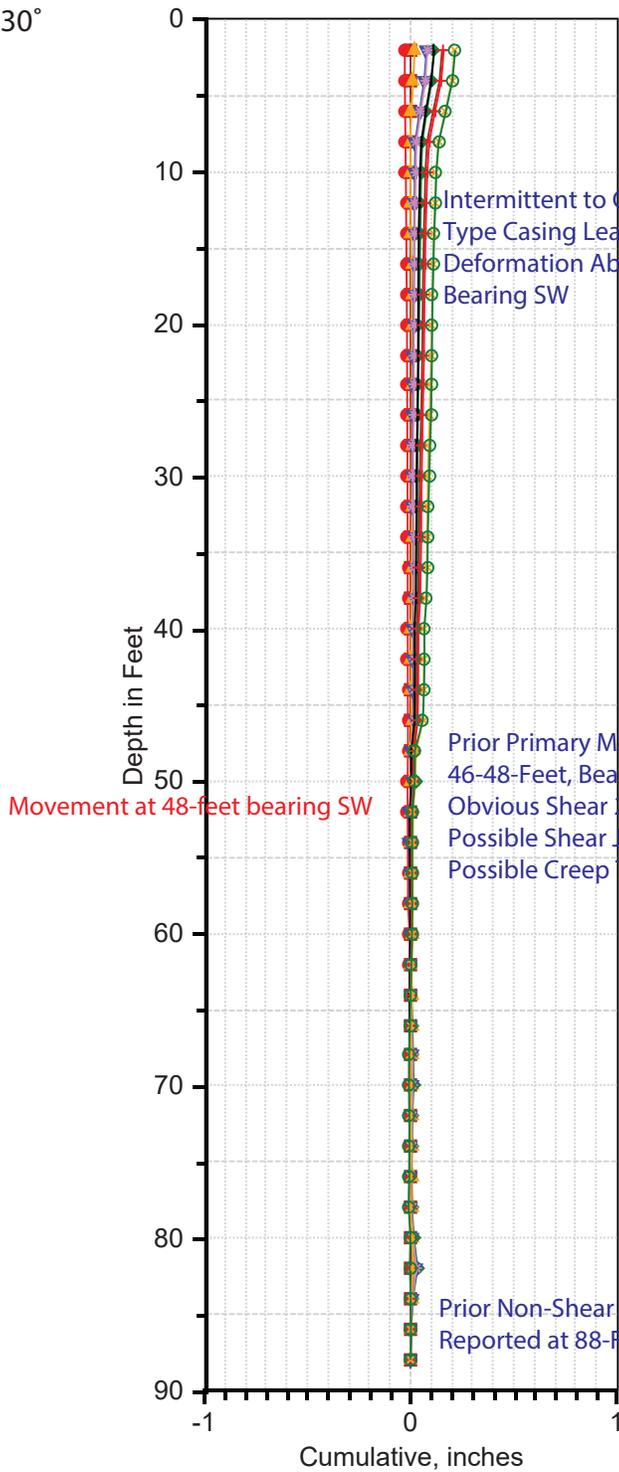
Plot Type: Cumulative and Incremental		Plot Direction: B-Direction	
Depth of Survey (ft): 74		Baseline Date: 5/3/21	
Install Date: 9/1998		Corrections: None	
Installed Depth (ft): 80	Interpreted Movement Since Baseline (in): 0	Interpreted Movement Monitoring Year (in): 0	



PROJECT: Calle del Barco LAD Malibu, CA	PROJECT NUMBER: 220-277
REVISION DATE: 3/12/2025	

A-
30°

A+
210°



- | | | | | | |
|--------------|-------------|--------------|-------------|--------------|-------------|
| ■ 5/3/2021 | ● 8/4/2021 | ▲ 5/18/2022 | ■ 5/3/2021 | ● 8/4/2021 | ▲ 5/18/2022 |
| ◆ 6/7/2023 | ▼ 8/23/2023 | ◆ 6/7/2023 | ▼ 8/23/2023 | ◆ 6/7/2023 | ▼ 8/23/2023 |
| — 11/14/2023 | — 2/8/2024 | — 11/14/2023 | — 2/8/2024 | — 11/14/2023 | — 2/8/2024 |
| — 3/28/2024 | ○ 5/2/2024 | — 3/28/2024 | ○ 5/2/2024 | — 3/28/2024 | ○ 5/2/2024 |

Plot of Slope Inclinometer

SI-16

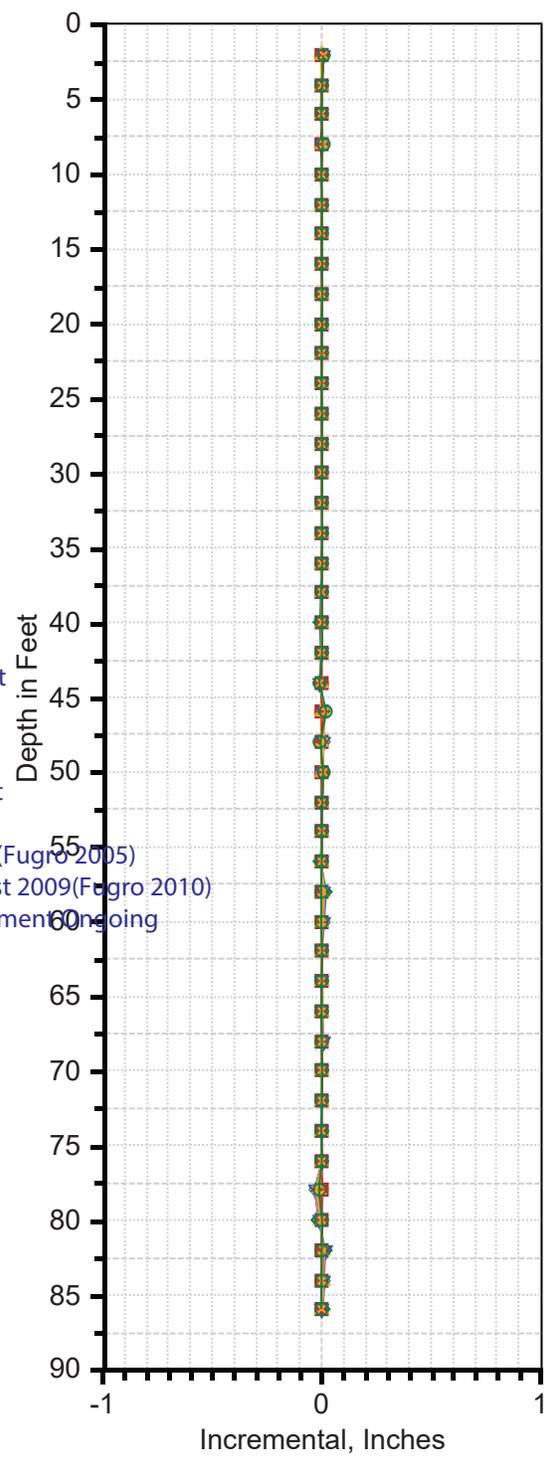
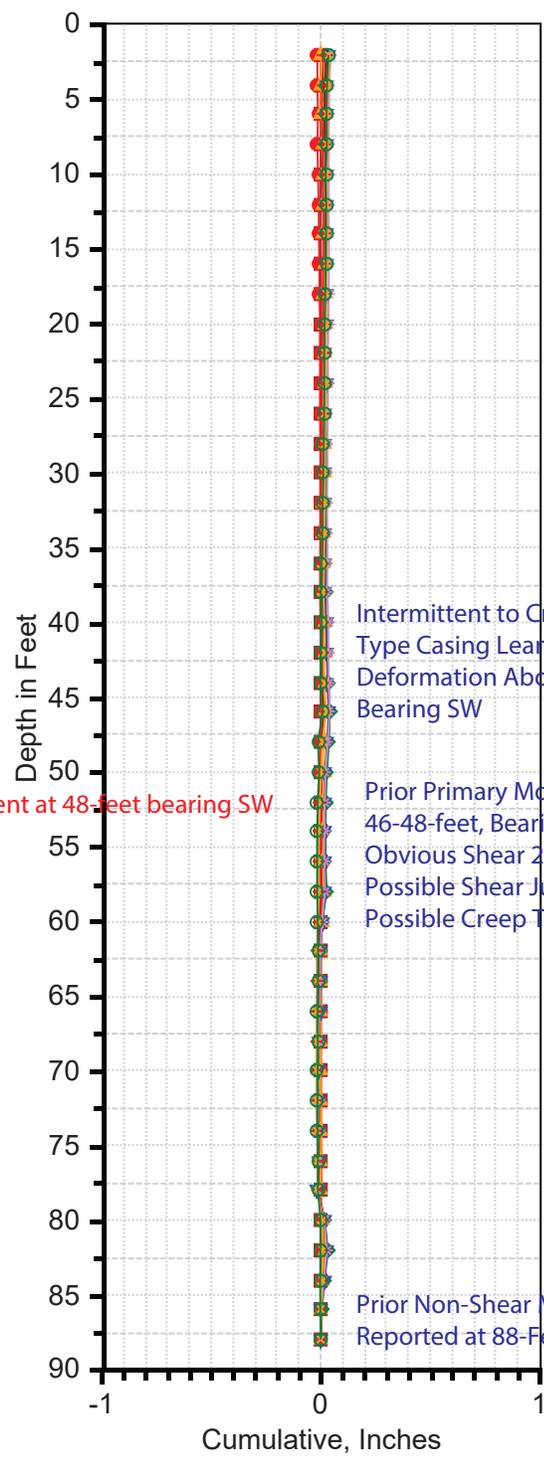
Plot Type: Cumulative and Incremental		Plot Direction: A-Direction	
Depth of Survey (ft): 86		Baseline Date: 5/3/21	
Install Date: 8/2003		Interpreted Movement Since Baseline (in): 0.3	
Installed Depth (ft): 88		Interpreted Movement Monitoring Year (in): 0.1	



PROJECT: Calle del Barco LAD Malibu, CA	PROJECT NUMBER: 220-277
REVISION DATE: 3/13/2025	

B-
120°

B+
300°



- 5/3/2021
- 8/4/2021
- ▲ 5/18/2022
- 5/3/2021
- 8/4/2021
- ▲ 5/18/2022
- ◆ 6/7/2023
- ▼ 8/4/2023
- ✦ 8/23/2023
- ◆ 6/7/2023
- ▼ 8/4/2023
- ✦ 8/23/2023
- ⊠ 11/14/2023
- ⊠ 2/8/2024
- ⊠ 2/13/2024
- ⊠ 11/14/2023
- ⊠ 2/8/2024
- ⊠ 2/13/2024
- ⊠ 3/28/2024
- 5/2/2024
- ⊠ 3/28/2024
- 5/2/2024

Plot of Slope Inclinometer <h1 style="margin: 0;">SI-16</h1>	Plot Type: Cumulative and Incremental		Plot Direction: B-Direction
	Depth of Survey (ft): 86		Corrections: None
	Install Date: 8/2003	Installed Depth (ft): 88	Interpreted Movement Since Baseline (in): 0.3

<p>Yeh and Associates, Inc. Geotechnical • Geological • Construction Services</p>	PROJECT: Calle del Barco LAD Malibu, CA	PROJECT NUMBER: 220-277
	REVISION DATE: 3/13/2025	

APPENDIX C - DEWATERING

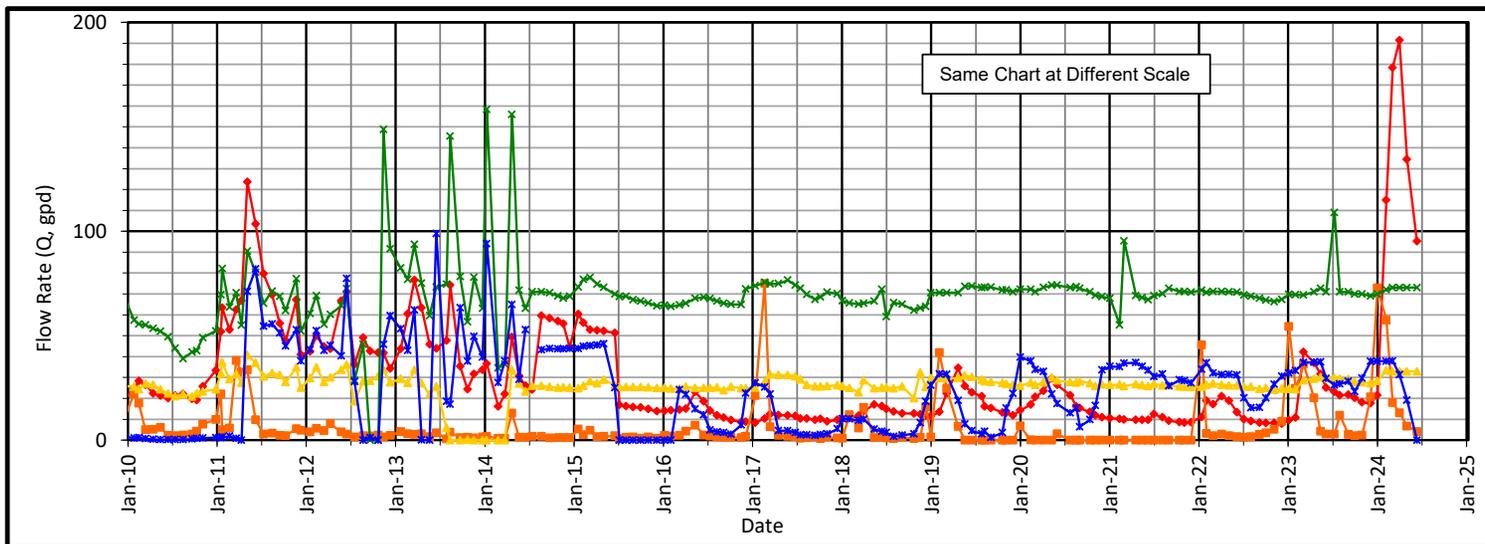
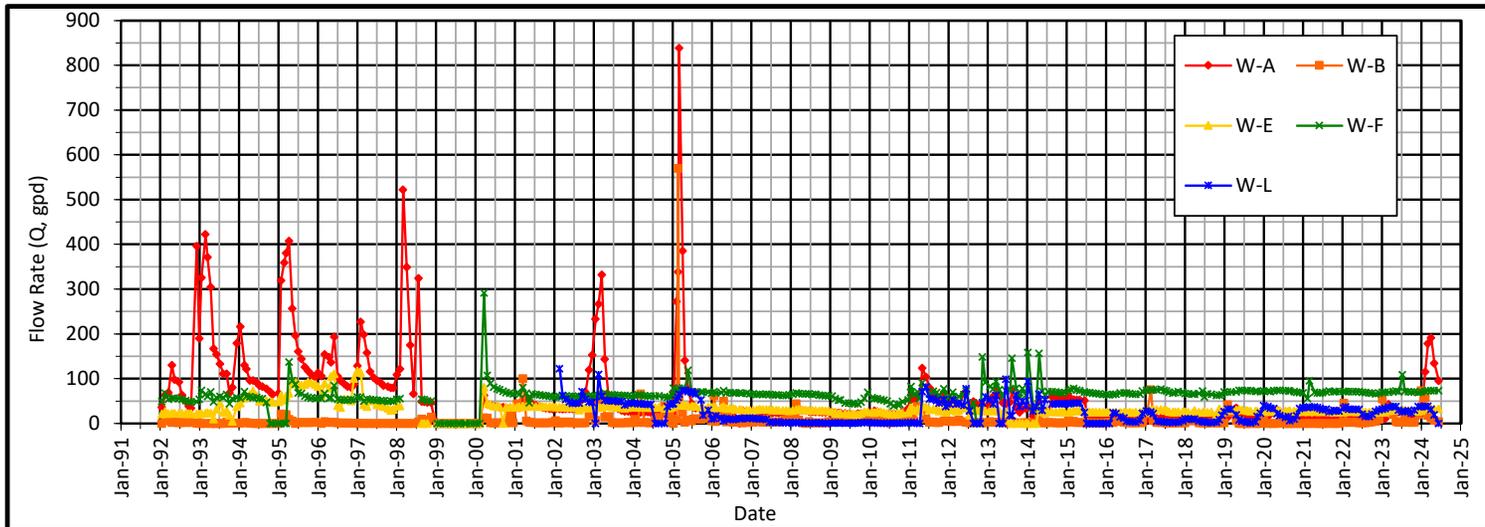
Dewatering Well Information							
Well ID	Vault Elevation (ft.)	Bottom Elevation (ft.)	Pump Elevation (ft.)	Pump Size (hp)	2023-2024 Pumping Rate (gpd)	% of Total Well Production	Comment
W-A	196.0	Unknown	45.0	1/2	71.5	9%	
W-B	204.0	169.7	173.7	1/2	17.9	2%	
W-C	295.0	233.5	237.5	1/2	136.5	18%	
W-D*	297.0	Unknown	Unknown	none	0.0	0%	Destroyed '98
W-E	215.0	Unknown	116.5	1/2	30.4	4%	
W-F	210.0	109.0	112.0	1/2	74.5	10%	
W-G*	292.0	222.0	none	none	0.0	0%	No Pump, Dry
W-H	299.5	234.5	242.5	1/3	8.4	1%	
W-I	298.0	238.0	248.0	1/3	50.9	7%	
W-J	304.0	244.0	250.0	1/3	194.9	25%	
W-K	430.0	370.0	380.0	1/3	0.0	0%	Dry
W-L	258.0	189.0	192.5	1/2	28.0	4%	
W-M	302.0	242.4	245.0	1/2	156.1	20%	

Note: * Non-functioning Dewatering Wells

Hydrauger Information						
Hydrauger ID	Installed Length (ft)	Functional Length (ft)	2023-2024 Flow Rate (gpd)	% of Total Production	Installed By	Comment
HD-1	93	unknown	0.0	0%	BYA	Destroyed per BYA (2000)
HD-2	127	unknown	0.0	0%	BYA	Destroyed per BYA (2000)
HD-3	155	unknown	0.0	0%	BYA	Destroyed per BYA (2000)
HD-4	80	unknown	0.0	0%	BYA	Destroyed per BYA (2000)
HD-5	65	unknown	0.0	0%	BYA	Destroyed per BYA (2000)
HD-6	97	unknown	0.0	0%	BYA	Destroyed per BYA (2000)
HD-7	227	unknown	0.0	0%	BYA	no production '21-'24
HD-8	290	unknown	0.0	0%	BYA	no production '21-'24
HD-9	230	unknown	0.0	0%	BYA	no production '21-'24
HD-10	330	unknown	0.0	0%	BYA	no production '21-'24
HD-11	230	unknown	0.0	0%	BYA	no production '21-'24
HD-12	330	unknown	0.0	0%	BYA	no production '21-'24
HD-13	210	unknown	84.4	25%	BYA	
H-1	240	unknown	129.8	38%	LA County	
H-2	180	unknown	0.0	0%	LA County	No outlet to monitor
ROWH-1	--	unknown	16.5	5%	BYA	discharge diverted from H-2
H-3	235	unknown	0.0	0%	LA County	Destroyed 1998
H-4	140	unknown	0.0	0%	LA County	Destroyed 1998
H-5	260	unknown	0.0	0%	LA County	Destroyed 1998
H-6	140	unknown	0.0	0%	LA County	Destroyed 1998
H-7	205	unknown	0.0	0%	LA County	Destroyed 1998
H-1A	100	92	0.0	0%	Fugro	no production '21-'24
H-2A	130	125	108.4	32%	Fugro	Flowing after January 2023, First time since 2014

DEWATERING WELL / HYDRAUGER INFORMATION

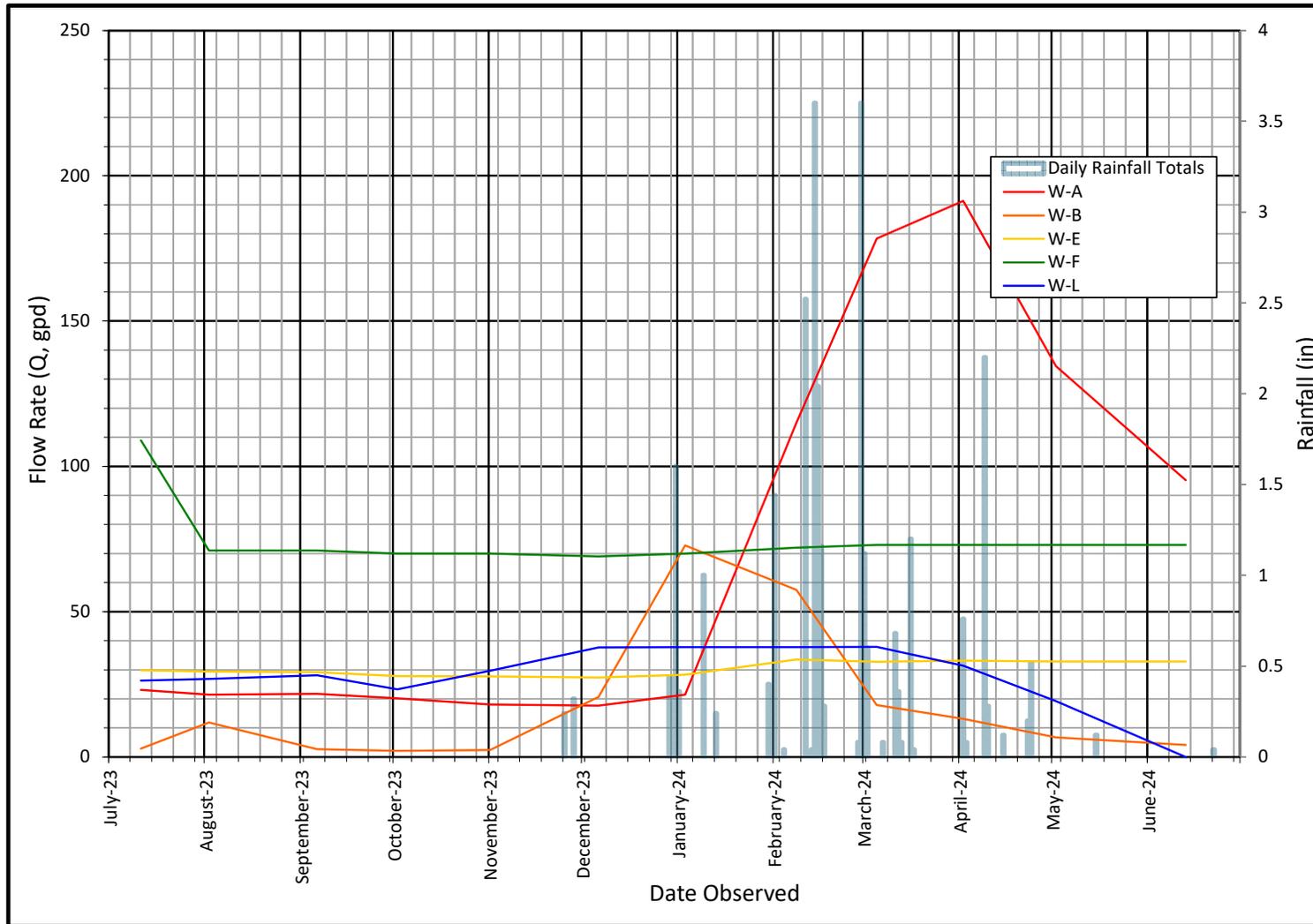
Calle del Barco Landslide Assessment District
 Malibu, California



DEWATERING WELL DISCHARGE RATE GRAPH (HISTORIC)

Rambla Orienta and Slope

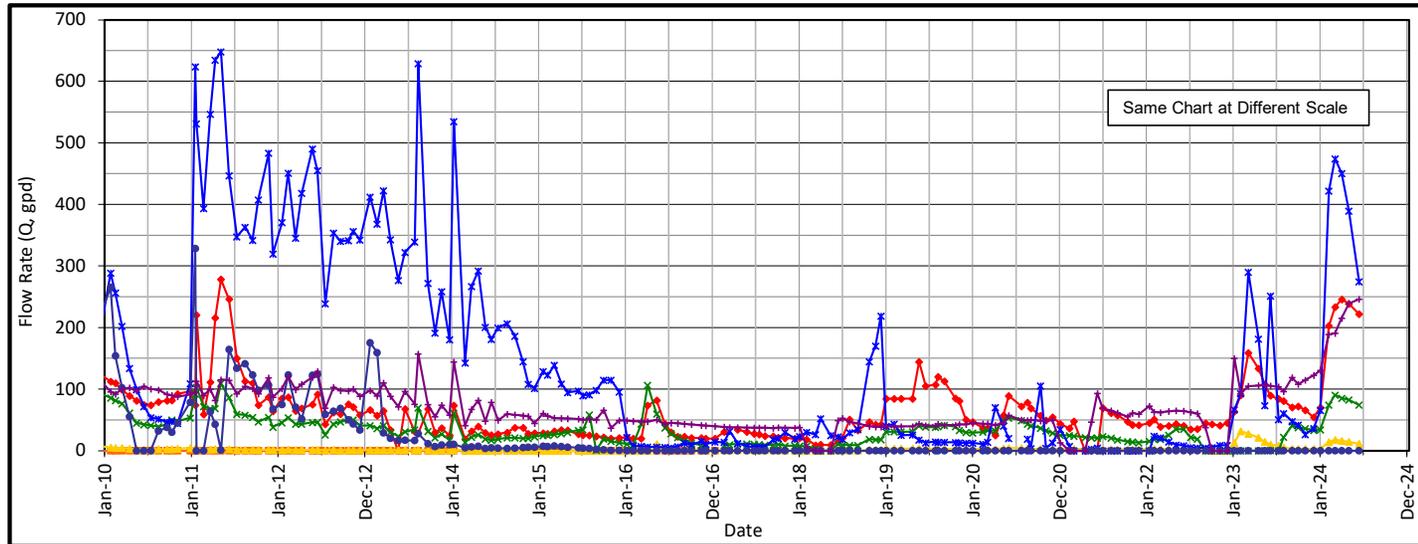
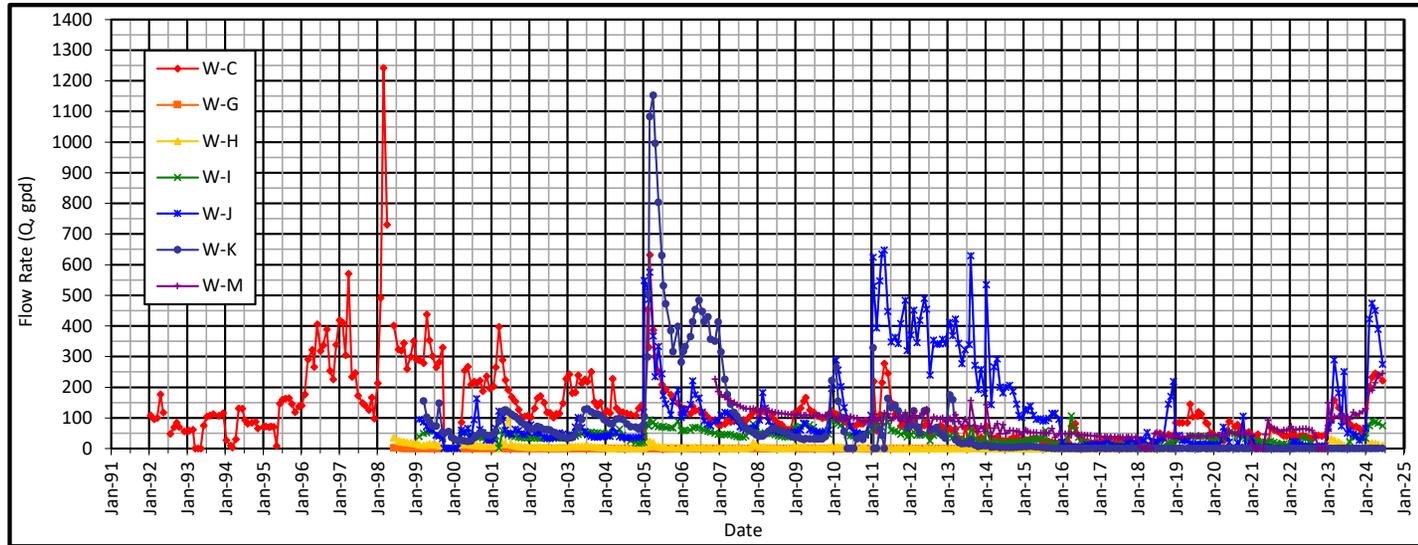
Calle del Barco Landslide Assessment District
Malibu, California



DEWATERING WELL DISCHARGE RATE GRAPH (MONITORING YEAR)

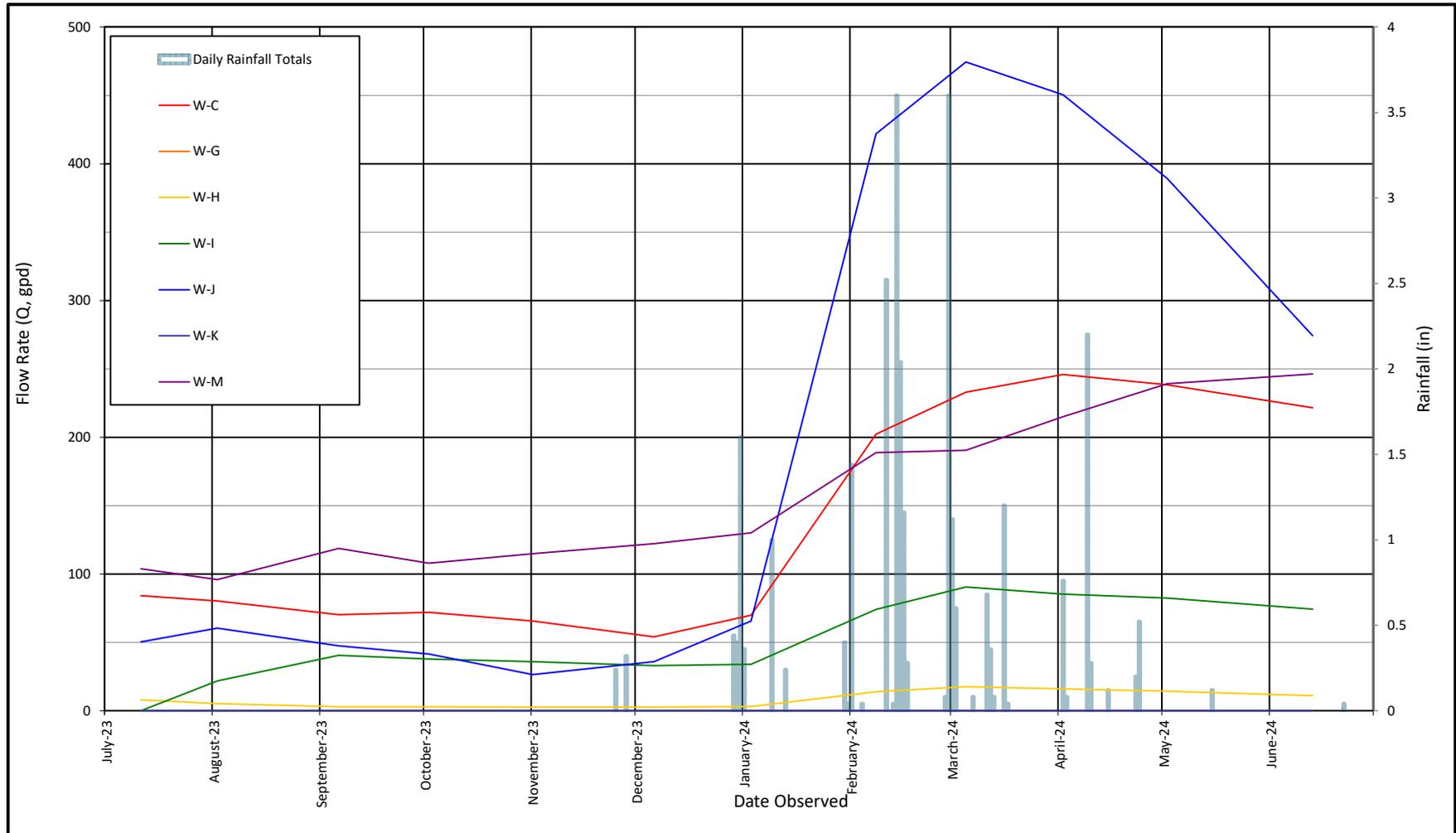
Rambla Orienta and Slope

Calle del Barco Landslide Assessment District
 Malibu, California



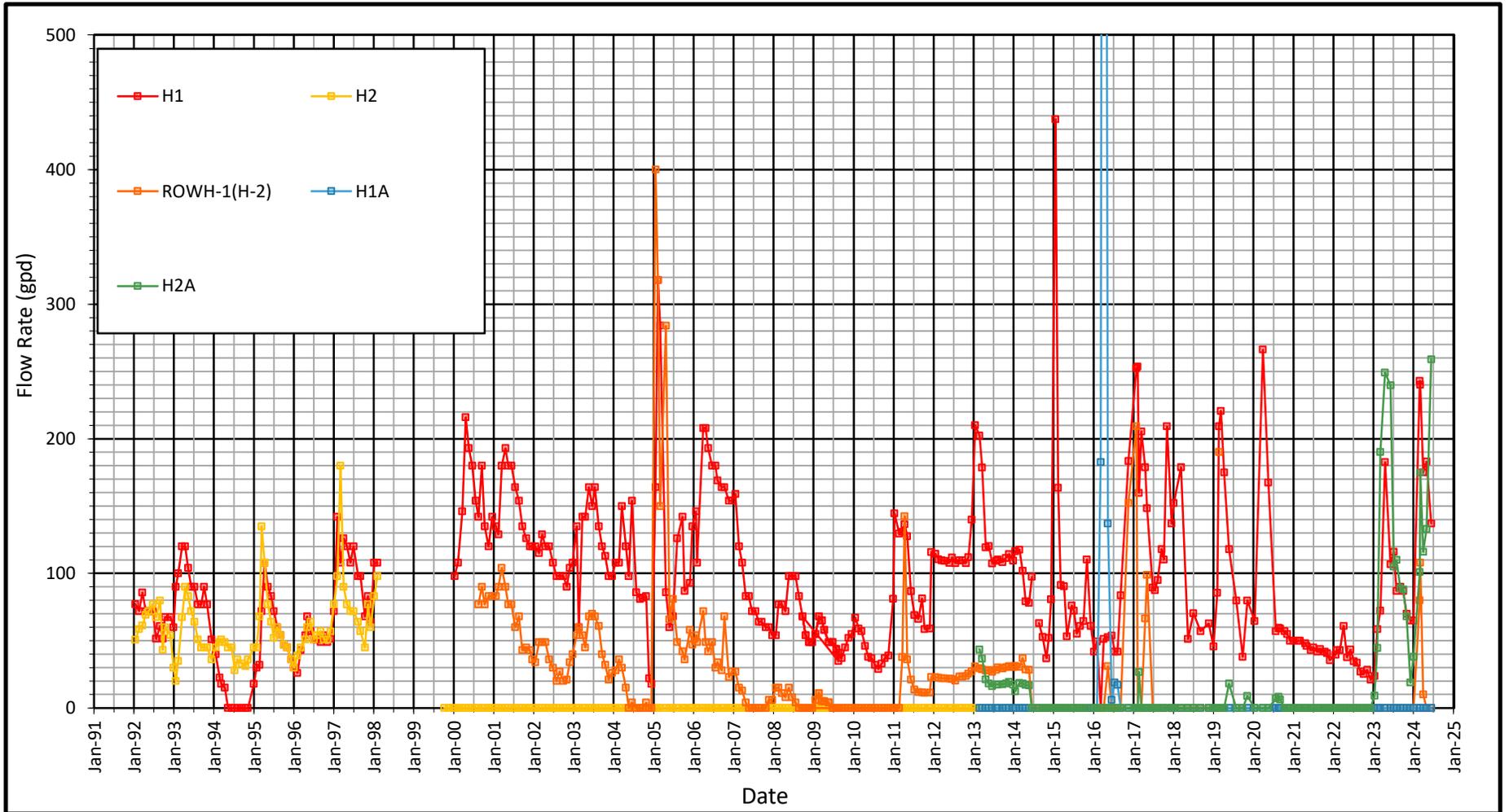
DEWATERING WELL DISCHARGE RATE GRAPH (HISTORIC)

Calle del Barco and Rambla Pacifico
 Calle del Barco Landslide Assessment District
 Malibu, California



DEWATERING WELL DISCHARGE RATE GRAPH (MONITORING YEAR)

Calle del Barco and Rambla Pacifico
 Calle del Barco Landslide Assessment District
 Malibu, California

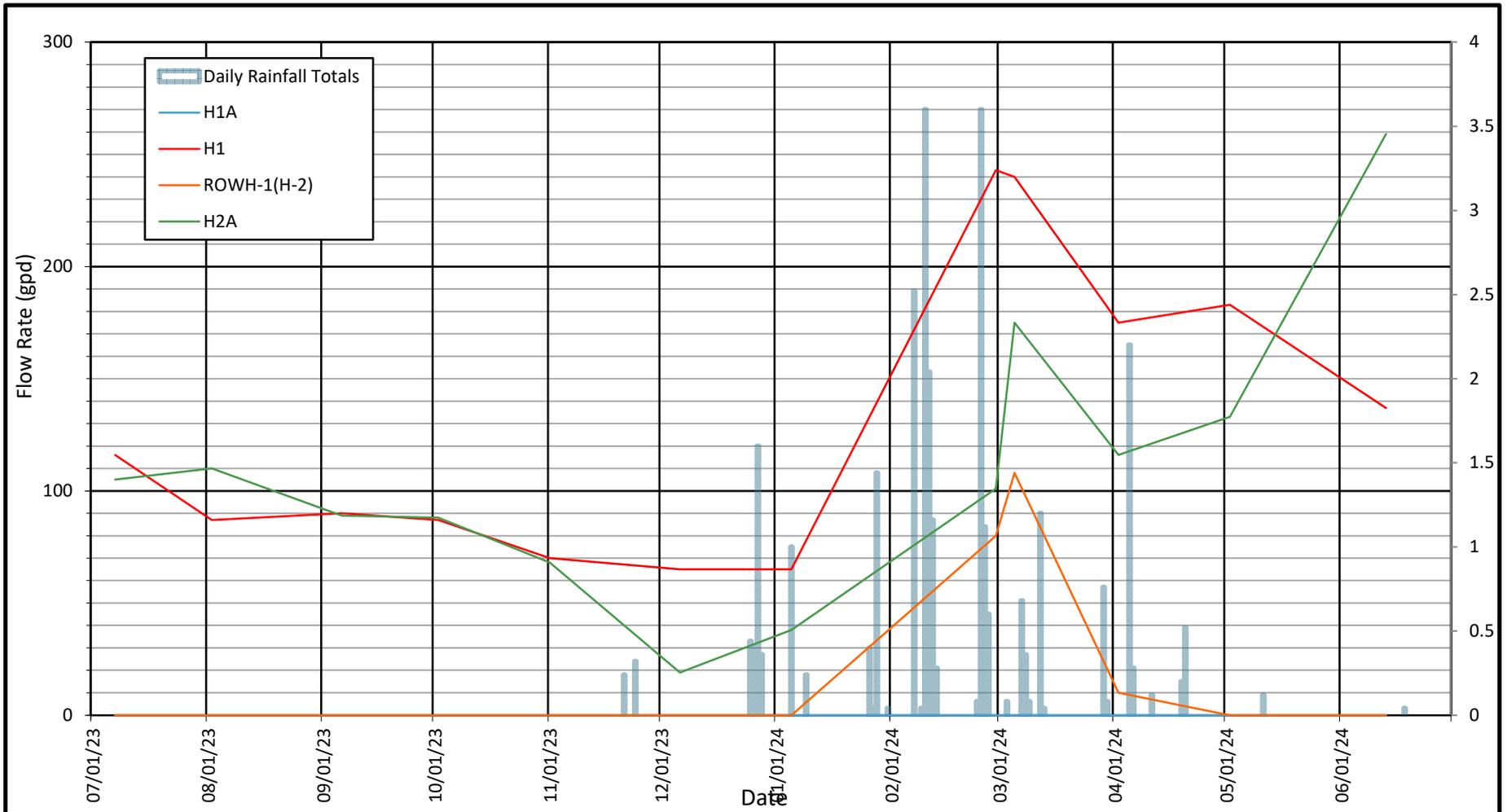


HYDRAUGER DISCHARGE RATE GRAPH (HISTORIC)

Rambla Orienta

Calle del Barco Landslide Assessment District

Malibu, California

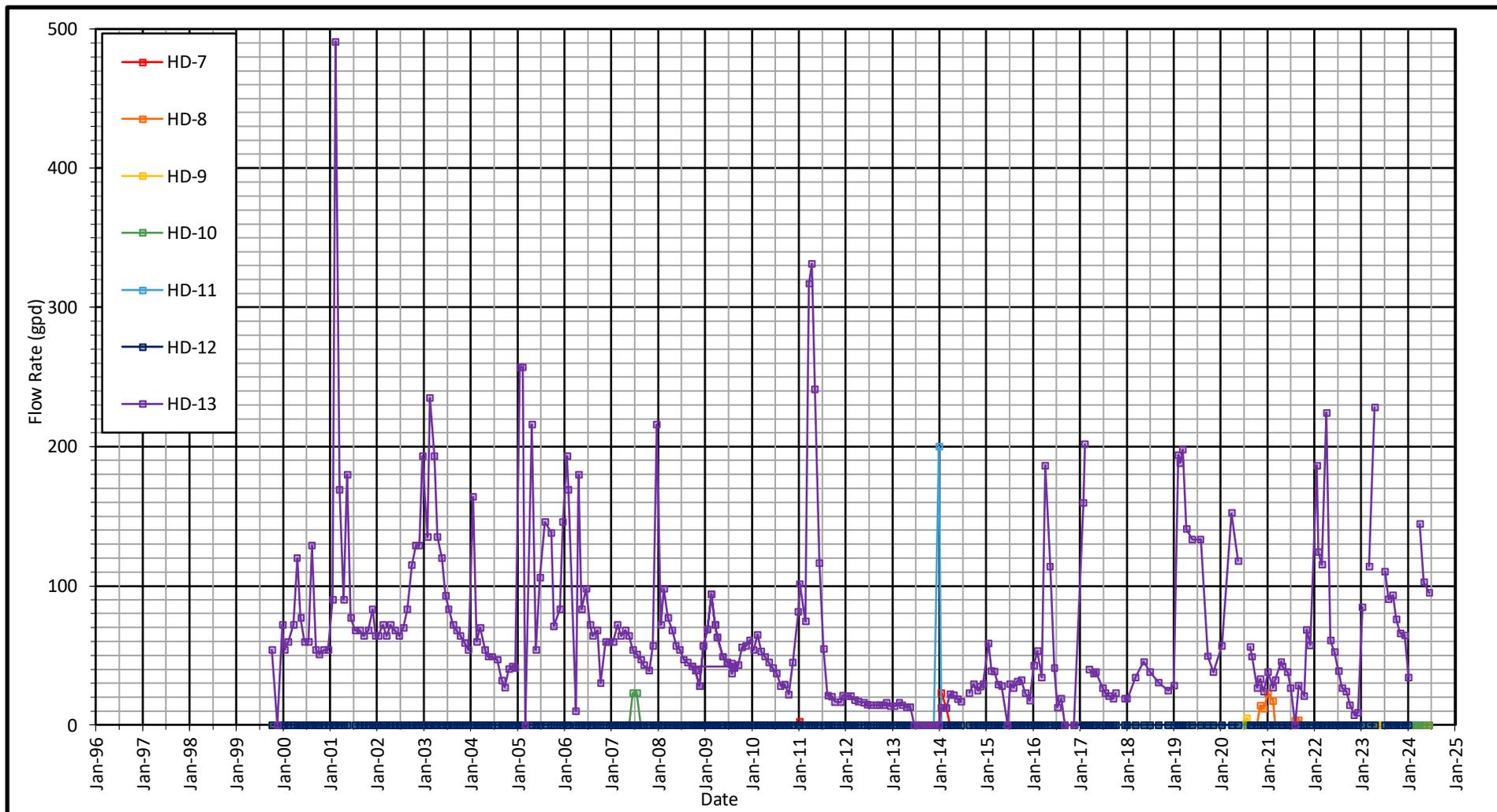


HYDRAUGER DISCHARGE RATE GRAPH (MONITORING YEAR)

Rambla Orienta

Calle del Barco Landslide Assessment District

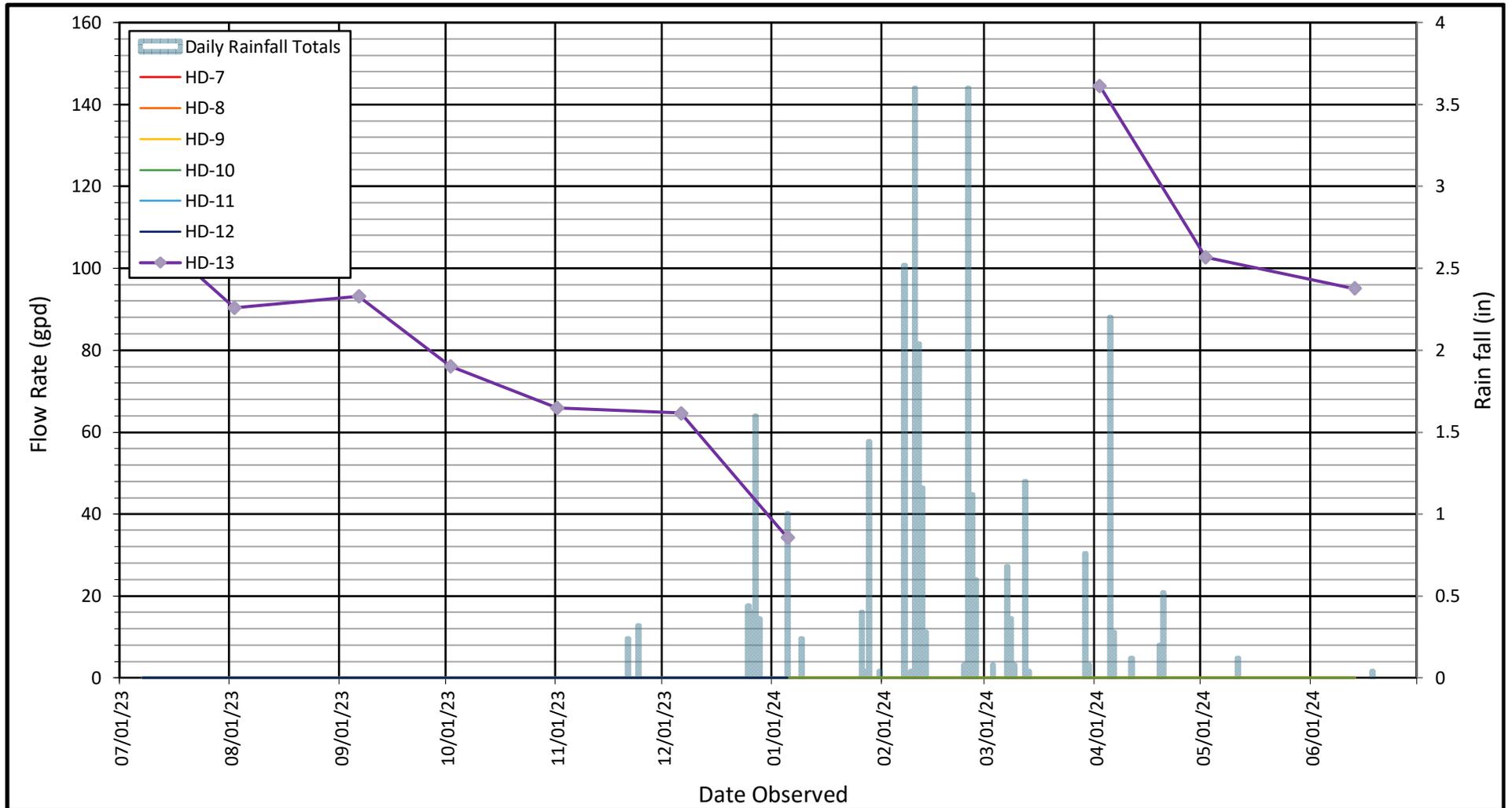
Malibu, California



HYDRAUGER DISCHARGE RATE GRAPH (HISTORIC)

Landslide Toe

Calle del Barco Landslide Assessment District
Malibu, California



HYDRAUGER DISCHARGE RATE GRAPH (MONITORING YEAR)

Landslide Toe

Calle del Barco Landslide Assessment District
 Malibu, California